APPENDIX B. CROSS SECTIONS & HYDRAULIC MODEL DOCUMENTATION

Typical representations of the topography along the valley bottom, river channel, and floodplain in the Upper Quinault River were needed for the sedimentation and geologic investigations of our study. Cross-sections were used to evaluate difference in ground surface elevation between side channels, main channel(s), and other geologic surfaces described in the report. Cross-sections were also utilized to estimate the depth of sediment in storage in gravel bars and vegetated surfaces (depth above average main channel bottom). The cross sections were input to a hydraulic model. The model was used to get a cursory level approximation of: 1) if hydraulic controls present in the low flow channel get drowned out at higher flows; and 2) how average hydraulic parameters (velocity and slope) changed throughout the study reach at the 2-year flood level. The hydraulic model was not calibrated and verified to a level that would be done in standard engineering practice, which would be necessary if the model is to be used for design level application in future studies or restoration project implementation.

Cross-section generation

Cross-sections were generated approximately every 0.5 kilometer from Lake Quinault to just upstream of the Forks (Figure 1). Cross-section data was generated in a geographical information system (GIS) from a digital terrain model (DTM) that represented the channel and flood plain topography (see topographic data appendix for discussion on accuracy of DTM and Lidar data). The program utilized by Reclamation to generate the cross-sections is called Georas, which is beta version software developed by the Corps of Engineers to provide an interface between GIS data and their hydraulic model Hec-Ras (see next section). Summary plots of each cross-section are provided in Attachment 1. Note that the cross-sections are labeled by corresponding river distance in meters along the 2002 low flow channel increasing in the upstream (see Figure 1), and are in SI (metric) units. Three cross-sections were added beyond the extent of the river channel to incorporate the lake geometry at the downstream end of the model (and study reach) based on measured survey from October 2002. These cross sections are labeled 100, 200, and 300. Nine cross sections were interpolated using an interpolation program in Hec Ras between the end of the lake cross-sections and the start of the first river cross-section (between cross section river stations 300 and 343).

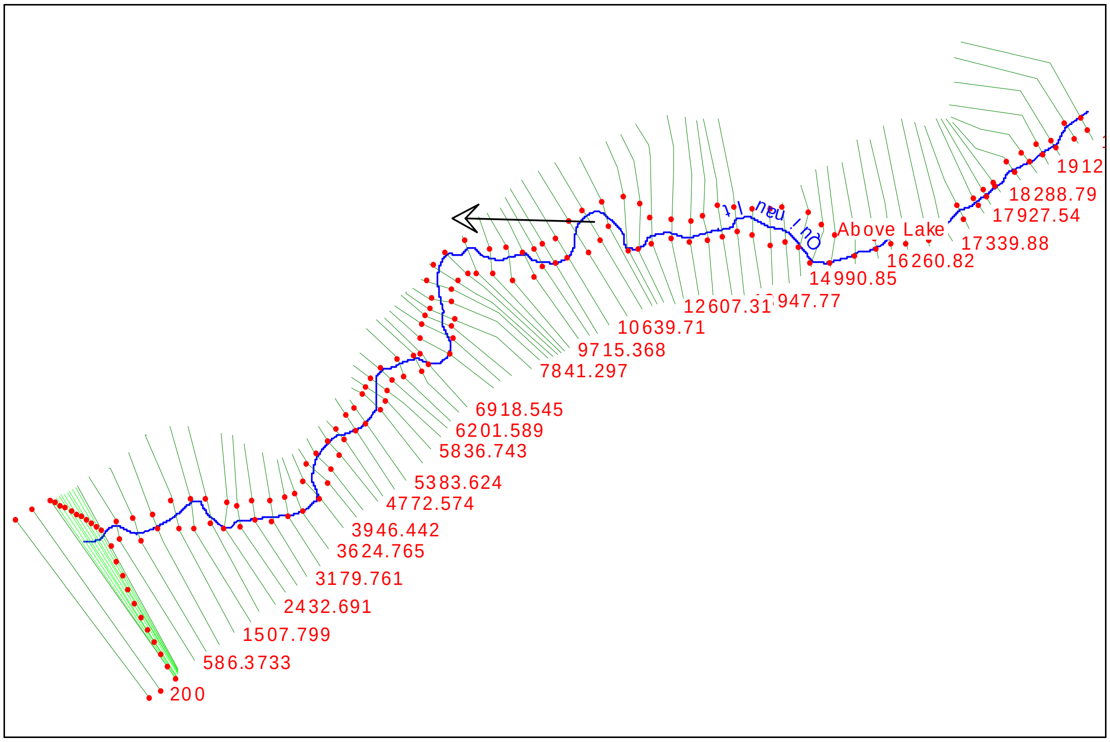


Figure 1. Cross-section identification drawing. Cross-section stationing shown in red numbers which represents the distance in meters upstream from Lake Quinault. Red dots represent width of unvegetated active channel.

Model Documentation

The one-dimensional U.S. Army Corps of Engineers numerical HEC-RAS computer model (Hydraulic Engineering Center - River Analysis System, version 3.1.1, Brunner, May 2003) was applied to the Quinault River to predict average hydraulic properties (water surface elevation, depth, mean velocity, and channel capacity). The HEC-RAS model performs water surface profile and other hydraulic calculations for one-dimensional steady flow. The model was forced to work in the sub-critical and critical flow regimes. The model predicts river stage and other hydraulic properties at each cross section along the river for any specified discharge. Water discharges used in the model were the measured discharge during the river channel survey and flood frequencies developed at the USGS gage at the outlet of Lake Quinault ranging from the 2- to the 100-year flood. Note that cross-sections and discharges in the model are in SI (metric) units.

Several types of energy loss coefficients are utilized in the HEC-RAS model. The primary one is friction losses associated with channel bed roughness, which is set using the Manning's *n* value. Manning's *n* values are determined based on the surface roughness, vegetation, channel irregularities, channel alignment, scour and deposition, obstructions, size and shape of the channel, stage and discharge, seasonal change, temperature, and suspended load and bedload. No measured Manning's n data was available for the Quinault River, and therefore, best estimates were made based on past experience in other gravel bed rivers. A Manning's n of .04 was used in the active channel areas, and .08 in the overbank areas. These roughness estimates could be further refined to identify localized areas where roughness differs from the average roughness within the active channel or floodplain if additional modeling is needed at a more detailed level for future studies (create more roughness breaks across each section).

Two flows were modeled for our study: 1) the measured flow of 11.5 m^3/s to get a rough idea of the model's ability to replicate measured flow conditions; and 2) a 2-year flood to provide estimates of velocity for unit stream power computations we did in our sedimentation analysis. An additional rating curve set of flows was also modeled that ranged from a low flow of 10 m^3/s to near the 100-year flood of 1600 m^3/s. Hydraulic results from the rating curve analysis were used in our study to evaluate sediment transport capacity at particular cross-sections.

The 2-year flood was modeled two ways. The first approach was to use one 2-year flood value of 630 m^3/s determined from the measured gaging station data for the entire study reach (no change in magnitude in downstream direction as a result of tributary and runoff flow contribution). The second approach was to use 2-year flood values determined from using a USGS empirical approach that incorporates basin size and precipitation data (Table 1) (see attachment 2 of hydrology appendix for methodology).

Table 1. Flow values for 2-year flood based on empirical USGS equation that accounts for change in drainage basin size in downstream direction of study reach. The associated river kilometer (RK) location indicates the point at which the flow value is applied based on the cumulative basin size upstream of that location.

Return Period (years)	Location 1 (RK 18) (peak m^3/s)	Location 2 (RK 8) (peak m^3/s)	Location 3 (RK 0) (peak m^3/s)
2	530	630	700

This second approach results in an increase in discharge in the downstream direction of the study reach due to the increase in drainage basin size. In reality the 2-year flood would gradually increase in magnitude in the downstream direction from smaller tributaries and runoff from hillslopes, and have larger increases at the confluence with major tributaries. However, due to the limited hydrology and river flow data available, only the key points where the flow is assumed to increase the most were incorporated into the model. The largest increases in basin size occur when the two forks of the Quinault River join together at what is know as the Forks (river kilometer 18), at the confluence with Big Creek at river kilometer 8, and at the confluence with the Finley Creek alluvial fan located between river kilometer 2.5 to 4.5. Our hydrology analysis provided estimates of flow increase at the confluence with Big Creek and at the inlet to Lake Quinault. Because flow paths from Finley Creek extend for 2 kilometers across the main channel, a specific confluence location was not identified, but the value at the inlet to Lake Quinault would incorporate the additional increase in drainage basin size from Finley Creek. The flow values from the empirical hydrology analysis were incorporated into the hydraulic model by applying the discharges to three reaches:

1. River kilometer 0 to 4.5 using Location 3 flow value (700 m^3/s);
2. River kilometer 4.5 to 8 using Location 2 flow value (630 m^3/s); and
3. River kilometer 8 to 20 using the Location 1 flow value (530 m^3/s).

The downstream boundary condition in the model used was the recorded lake elevation (56 meters) during the survey for the measured survey data flow modeled (11.5 cms). For the 2-year flood, a relationship between river gage height and lake elevation developed by USGS was used to get a typical lake elevation of 59 meters recorded during 2-year flood magnitudes (~630 m^3/s) (see Chapter 2, p. 2.4 of watershed analysis for more information on USGS analysis, QIN, 1999). The highest lake level recorded was 62.7 meters associated with the flood of record of 52,600 m^3/s in November 1909. For all other model parameters such as constriction width coefficient, friction loss computation method, etc, the default parameters in Hec-Ras were utilized.

Existing Conditions Model Discussion

The existing conditions model was not calibrated or verified. However, a cursory level calibration check on the model was made by comparing the modeled water surface values to measured values for the October 2002 water surface elevation data collected by Reclamation during an average recorded discharge of 11.5 m^3/s (400 ft^3/s) (discharge as recorded at USGS gage at outlet of Lake Quinault). The comparison of the two data sets appeared reasonable given the data was collected at a fairly low flow (figures 2, 3, and 4). Because the model cross sections were spaced 0.5 kilometers apart the model does not always capture the influence of hydraulic controls (riffles and rapids) if they fall between cross section locations. These hydraulic controls are important at low flows when they have an influence on the water surface elevation upstream, but are less important when flows are high enough that these controls become drowned out (figure 5). Additionally, the model assumes a constant water surface elevation across each cross section, which in reality is not always true, particularly at split flow locations.

The model is presently most useful for qualitatively assessing hydraulics at larger flows that inundate the majority of the active channel and floodplain. Smaller flows on the Quinault River tend to be more complex and can follow several flow paths. If predictions are needed during low flow periods, a different modeling approach would be needed that incorporates closer spaced cross sections and would possibly require a two or three-dimensional model and/or groundwater components depending on the objective of the modeling. The present hydraulic model needs more calibration work and closer spaced cross sections if quantitative values are needed for smaller scale design purposes. However, using the model for relative comparisons of channel hydraulics at higher flows should provide reasonable results for reach scale comparisons (reaches several kilometers in length).

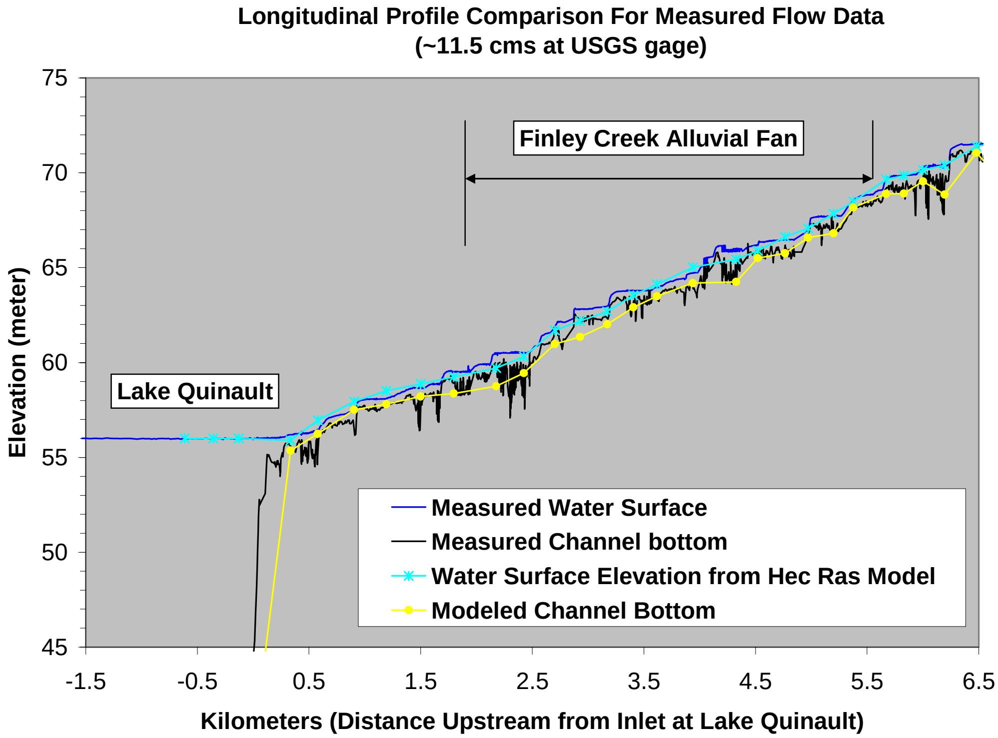


Figure 2. Comparison of measured to modeled water surface elevations in lower study reach.

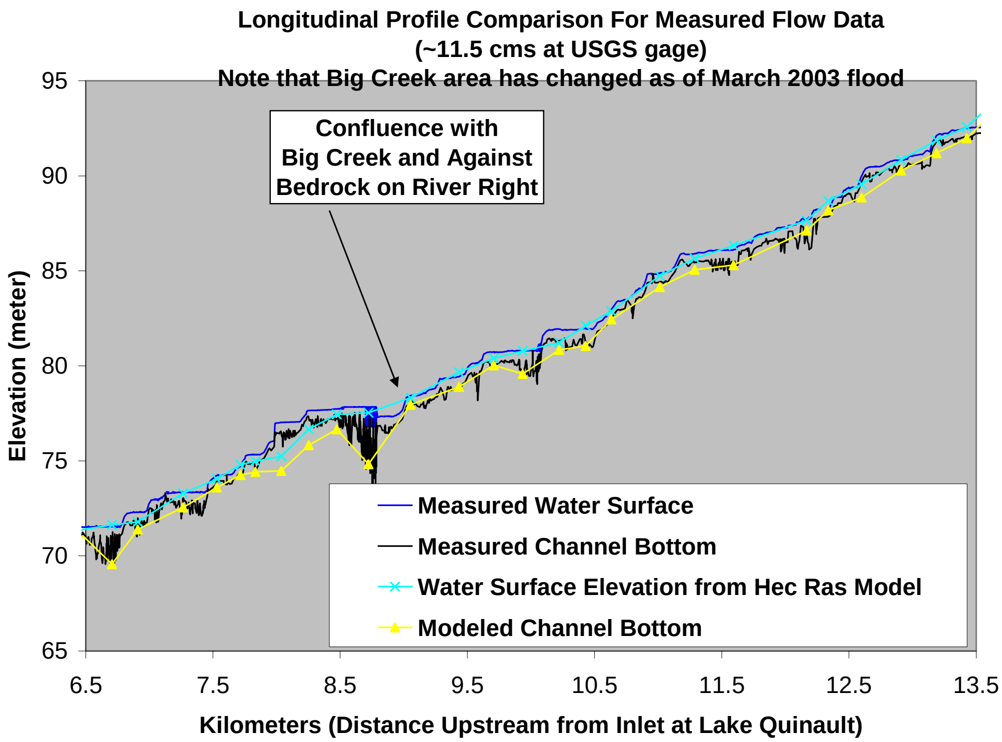


Figure 3. Comparison of measured to modeled water surface elevations in middle study reach.

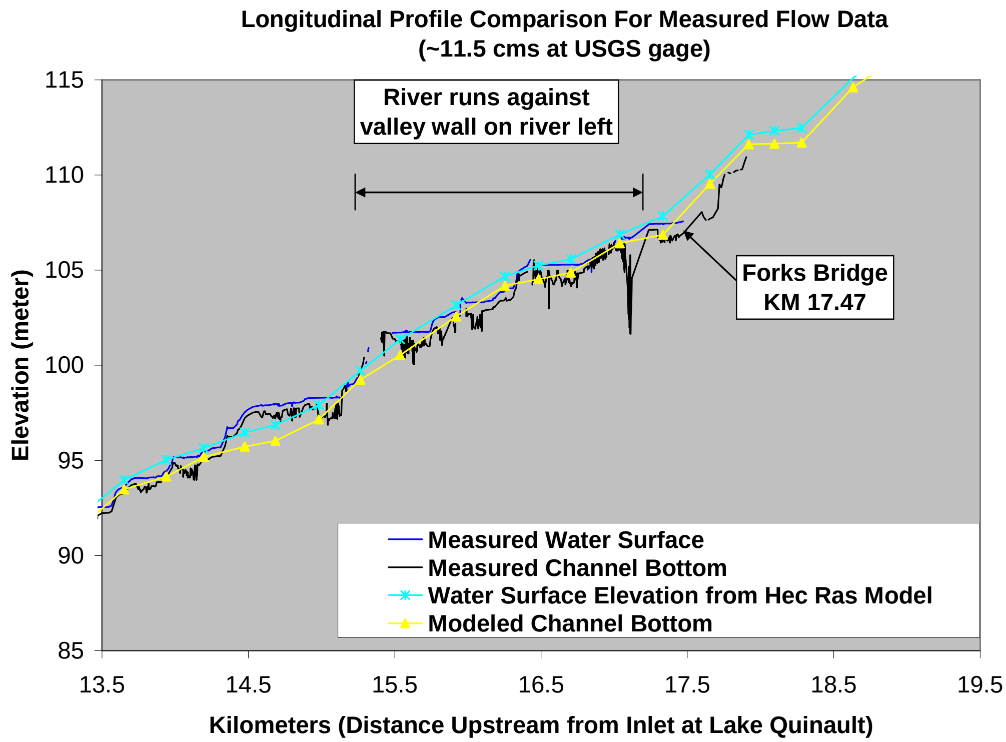


Figure 4. Comparison of measured to modeled water surface elevations in upper study reach.

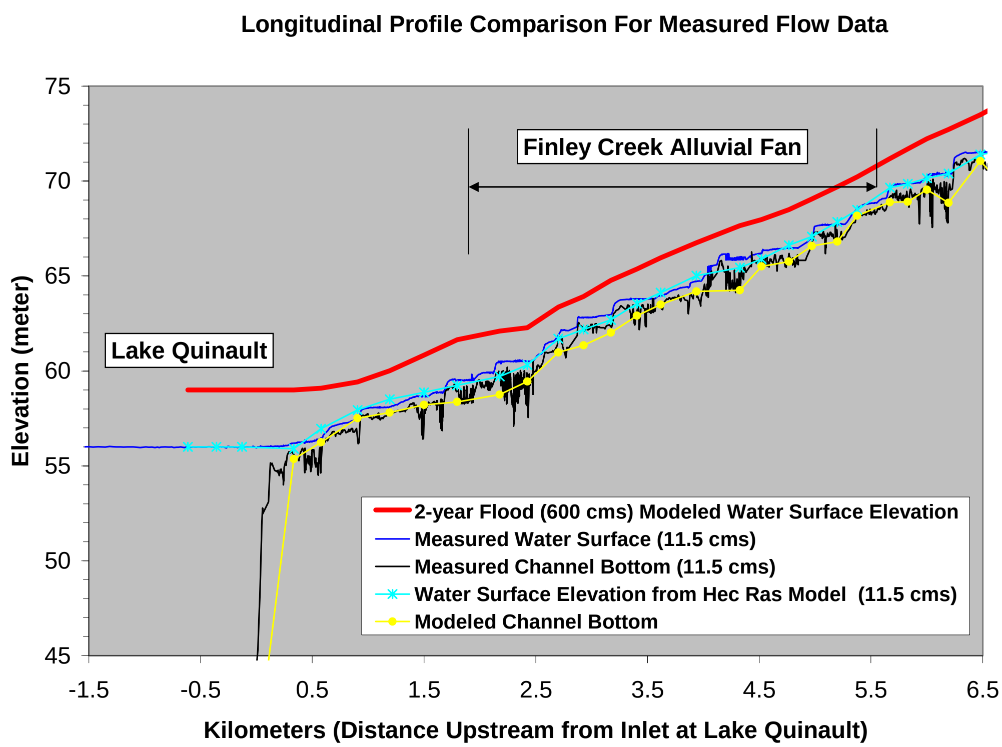
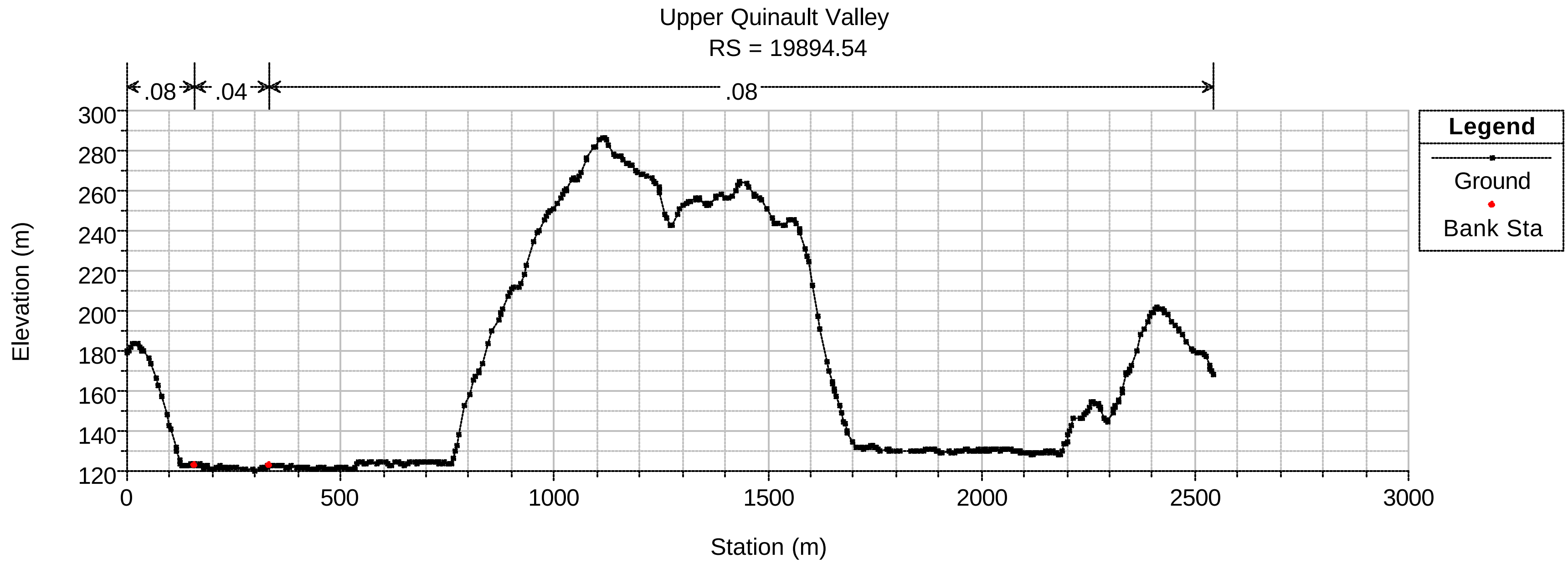


Figure 5. Comparison of 2-year flood to low flow water surface elevation demonstrating how most hydraulic controls get drowned out at larger flows.

ATTACHMENT 1 - CROSS SECTION PLOTS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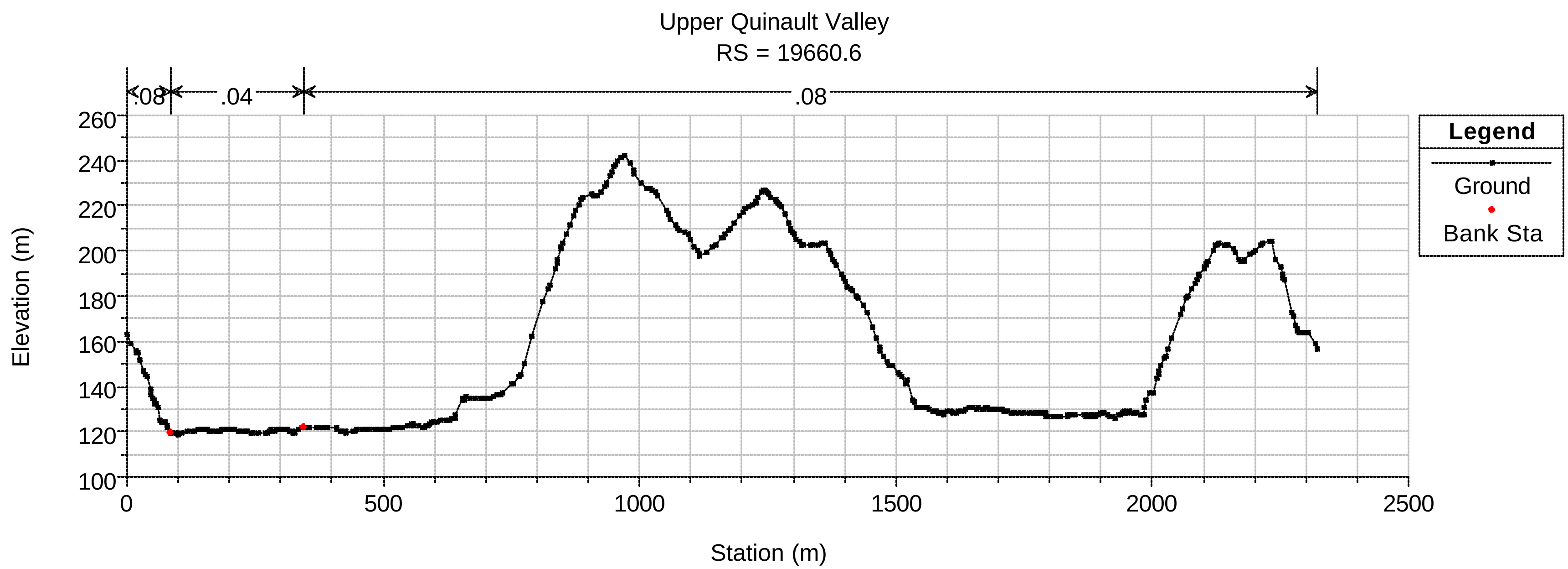
.08
.04
.08
300
280
260
240
220
200
180
160
140
120
0
500
1000
1500
2000
2500
3000
Elevation (m)
Station (m)
Legend
Ground
Bank Sta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.04
.08
260
240
220
200
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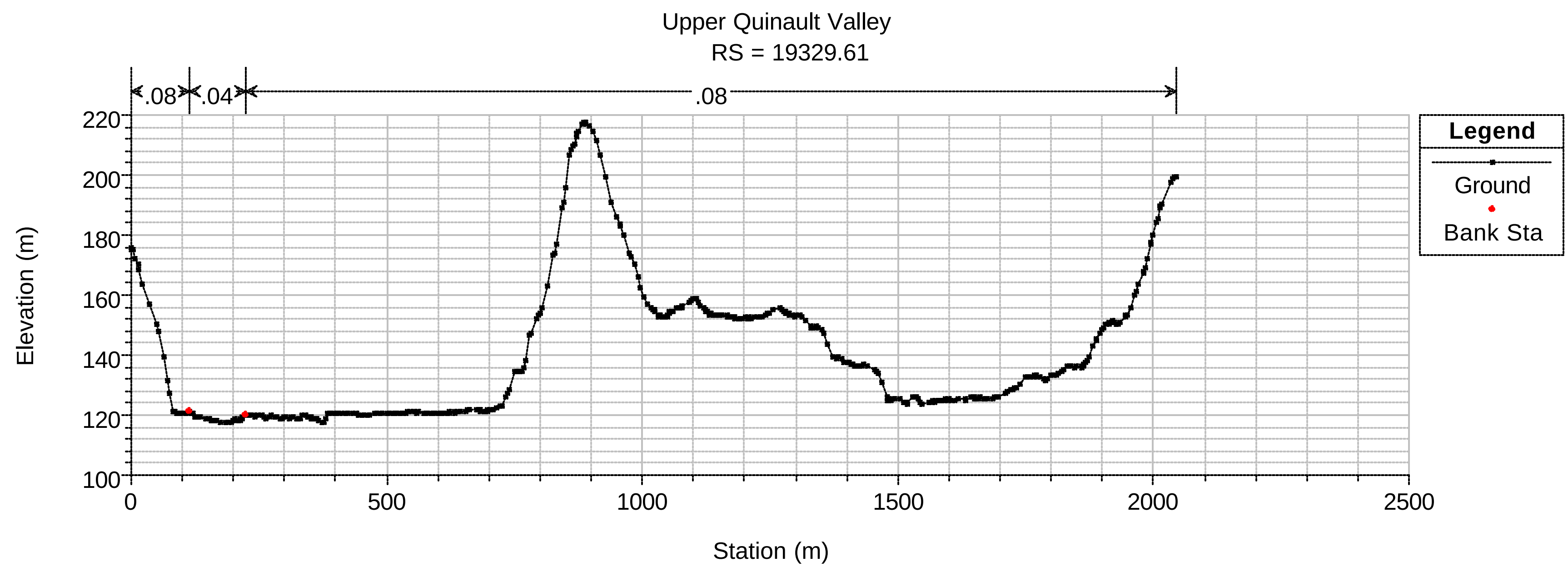
140
120
100
0
500
1000
1500
2000
2500
Elevation (m)
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
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.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta
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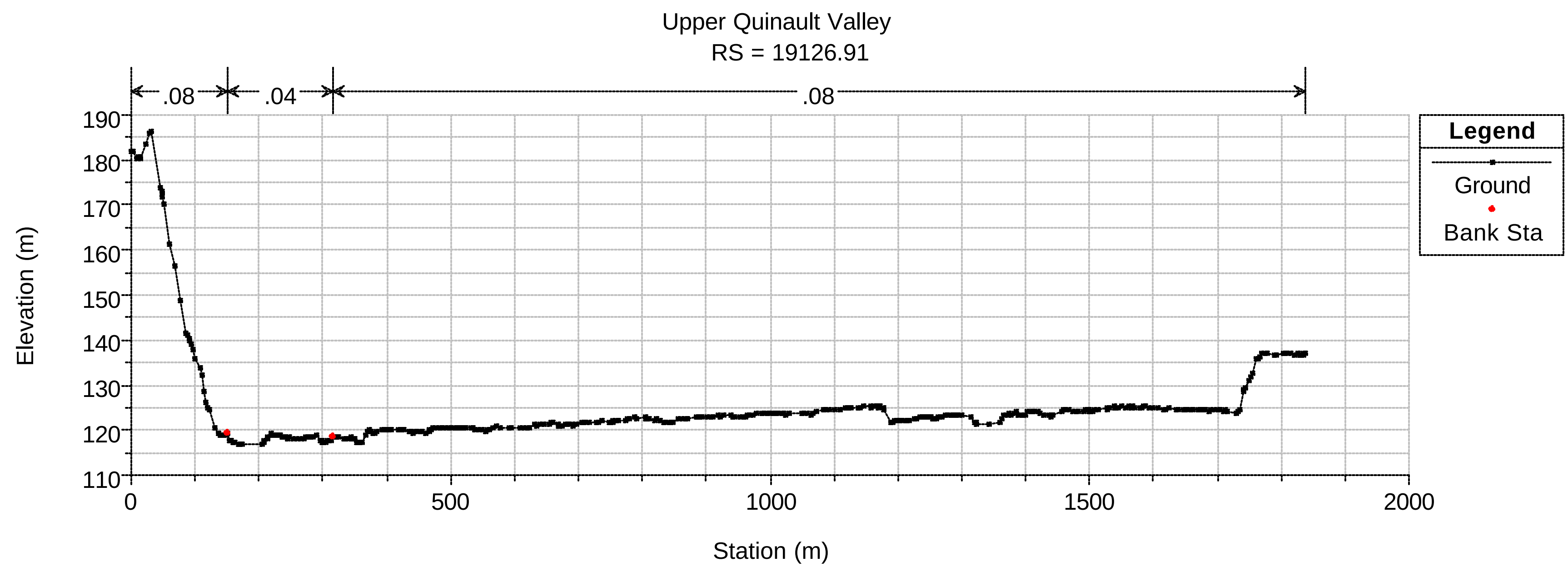
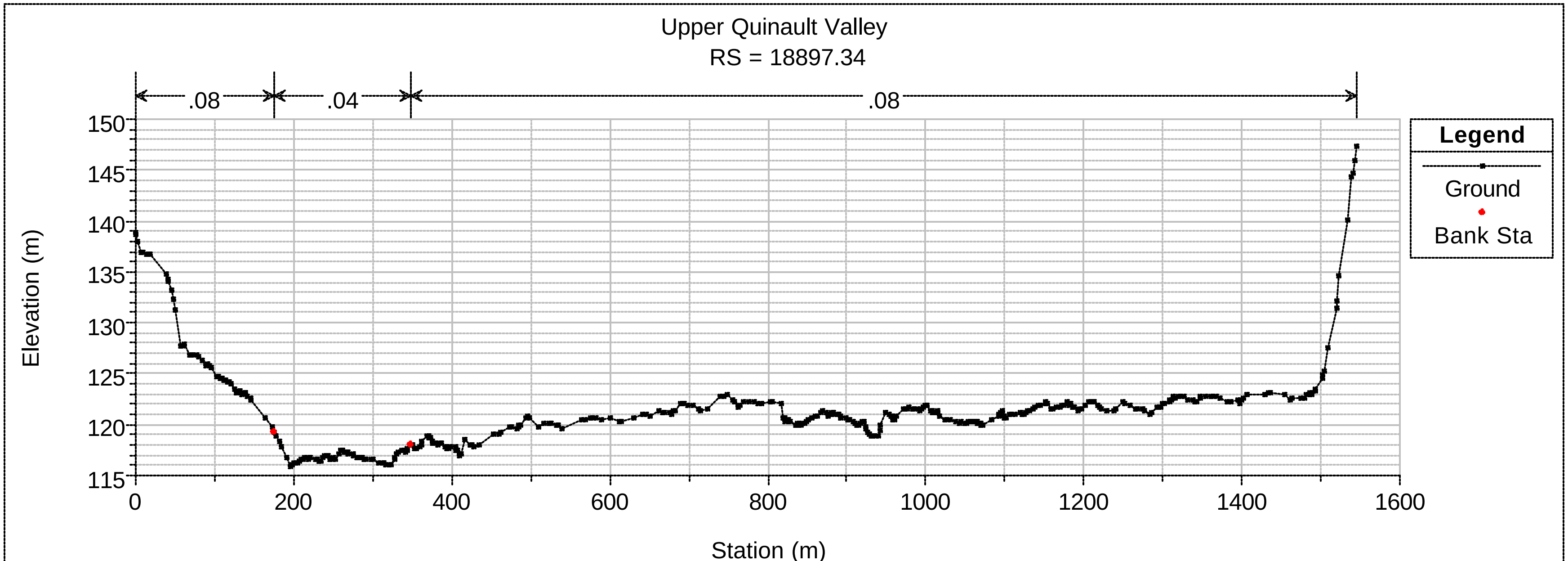
180
160
140
120
100
0
500
1000
1500
2000
2500


Upper Quinault Valley
RS = 19126.91
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta
190
180
170
160
150
140
130
120
110
0
500
1000
1500
2000



Upper Quinault Valley
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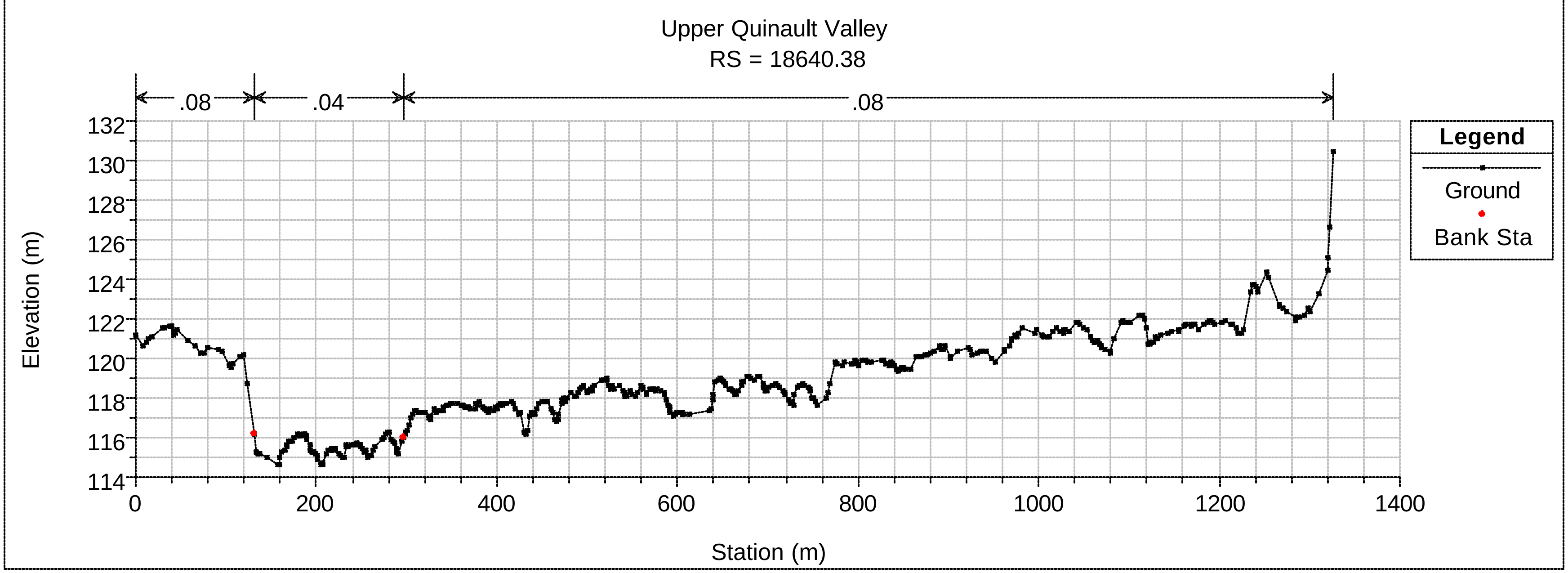
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta



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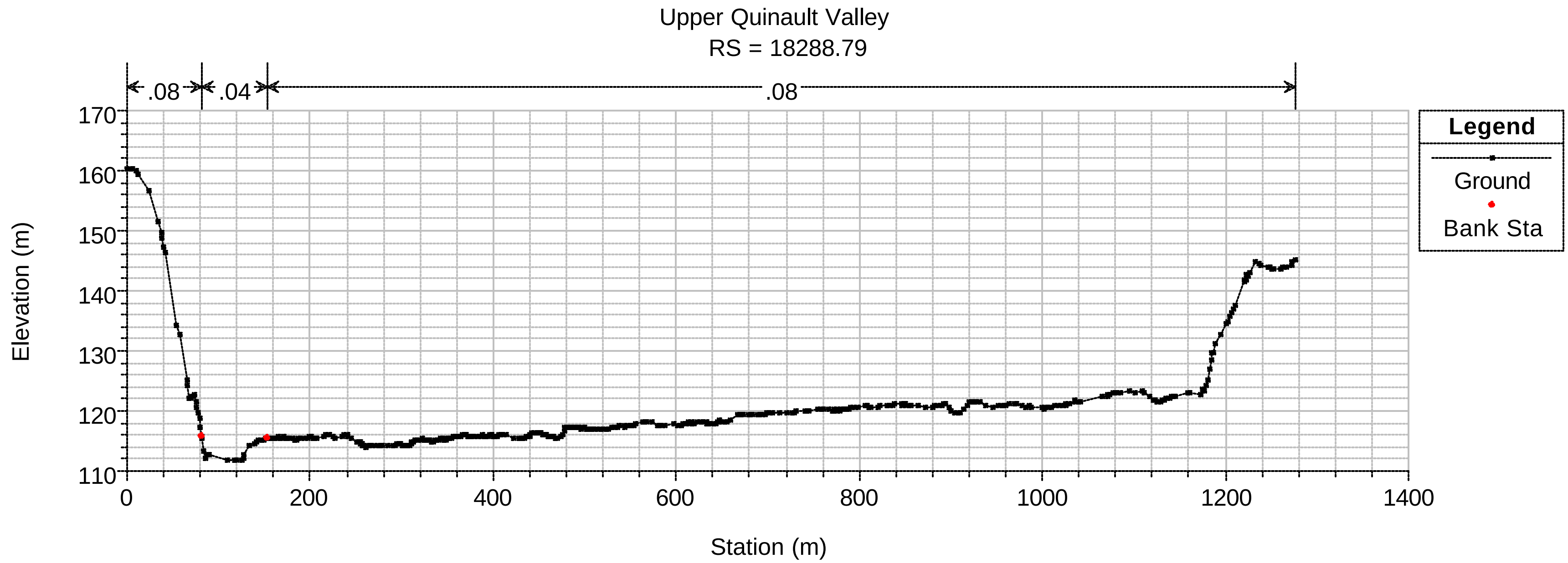
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta



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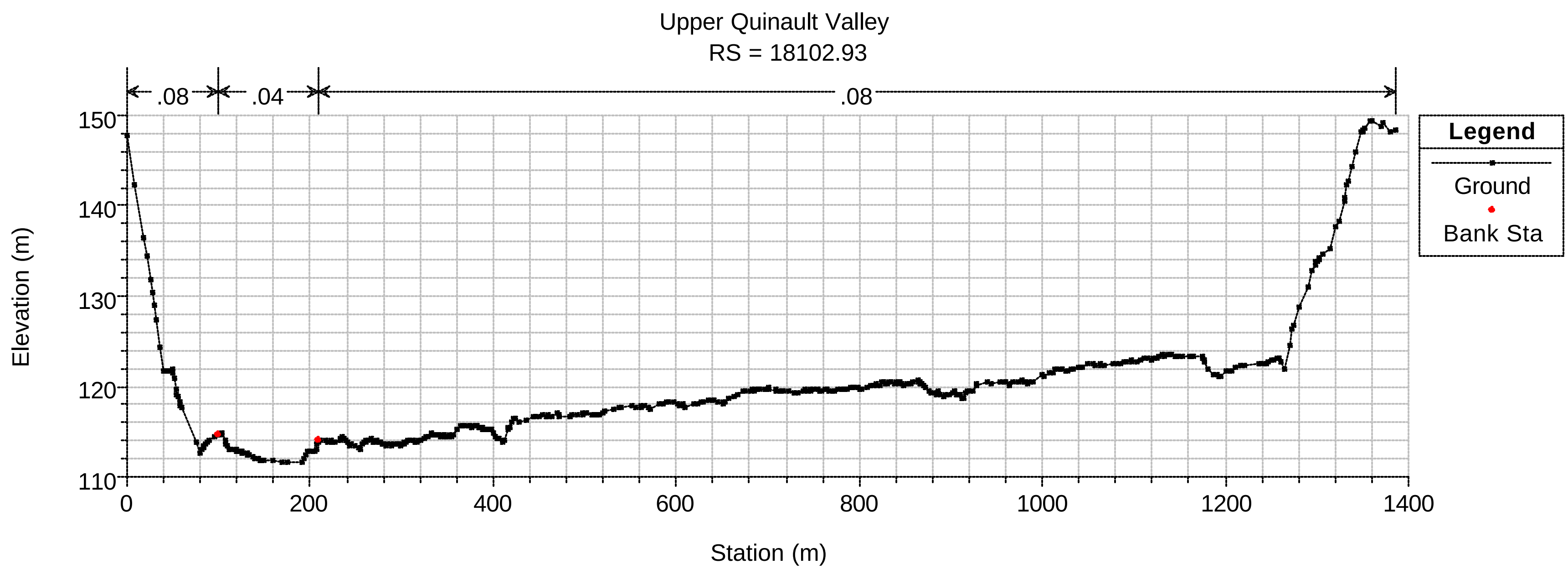
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta



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.04
.08
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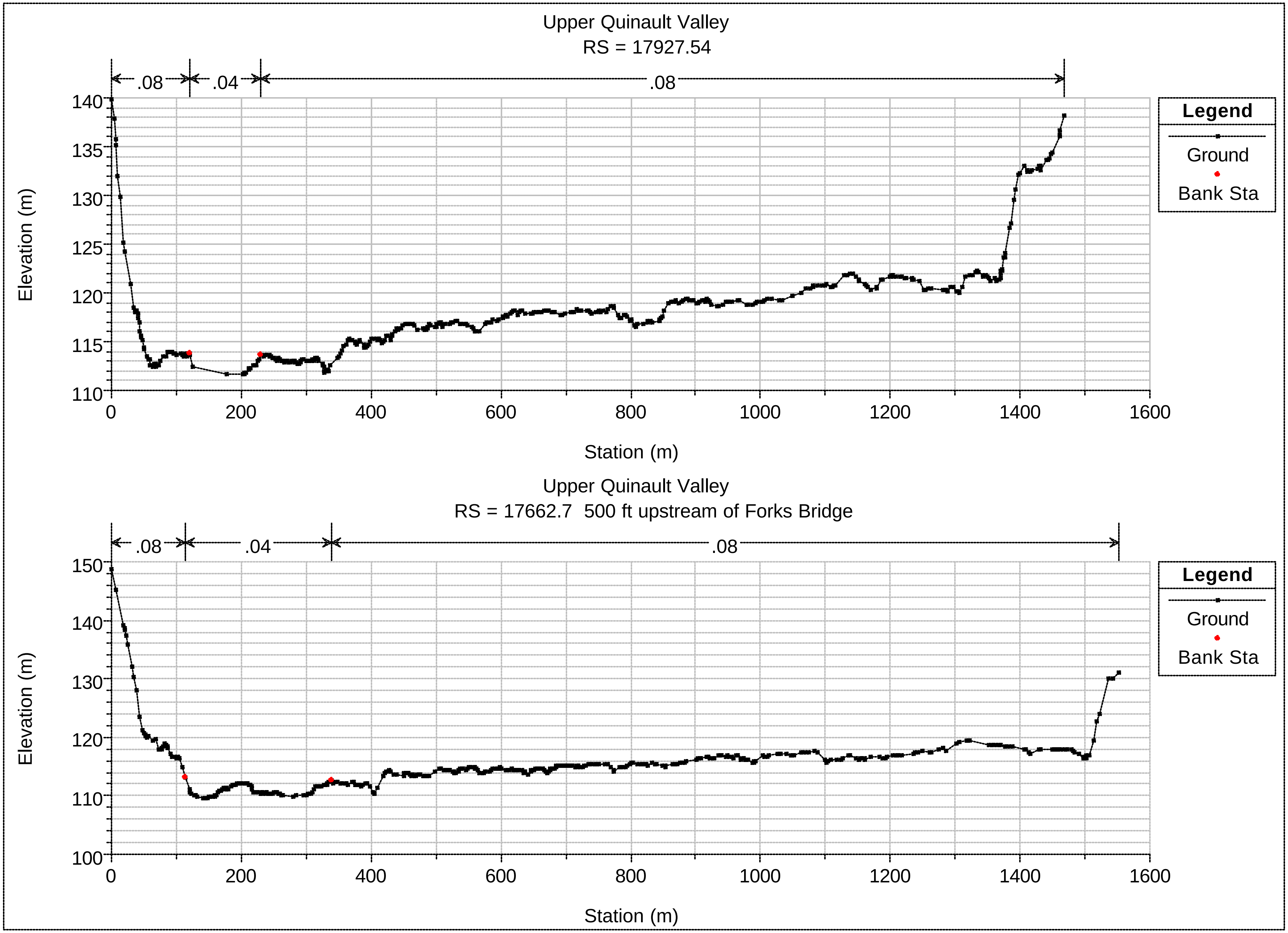
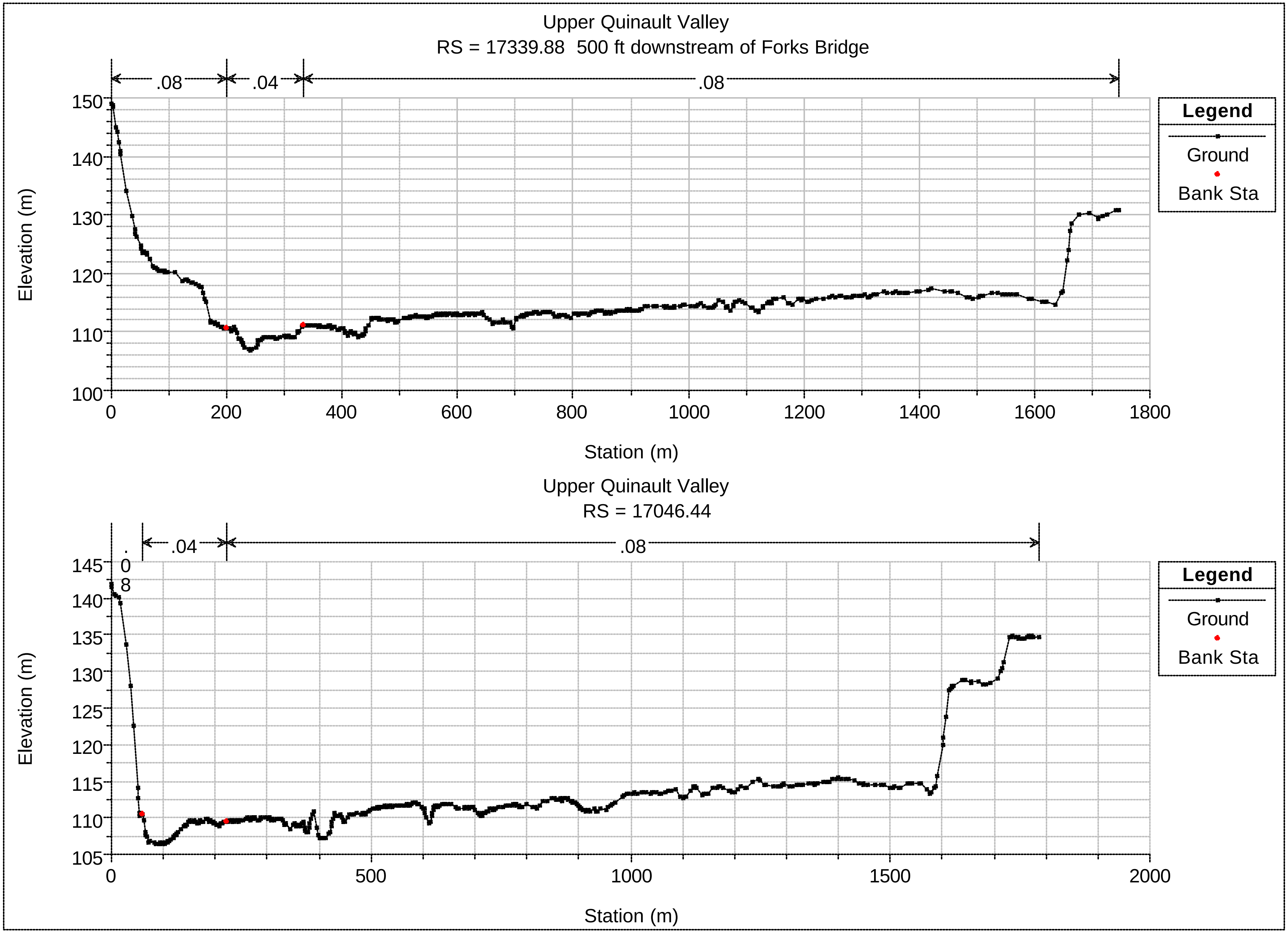
Station (m)
Legend
Ground
Bank Sta



Upper Quinault Valley
RS = 17927.54
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
Upper Quinault Valley
RS = 17662.7 500 ft upstream of Forks Bridge
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)



Upper Quinault Valley
RS = 17339.88 500 ft downstream of Forks Bridge
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
150
140
130
120
110
100
0
200
400
600
800
1000
1200
1400
1600
1800
Station (m)
Upper Quinault Valley
RS = 17046.44
.
0
8
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
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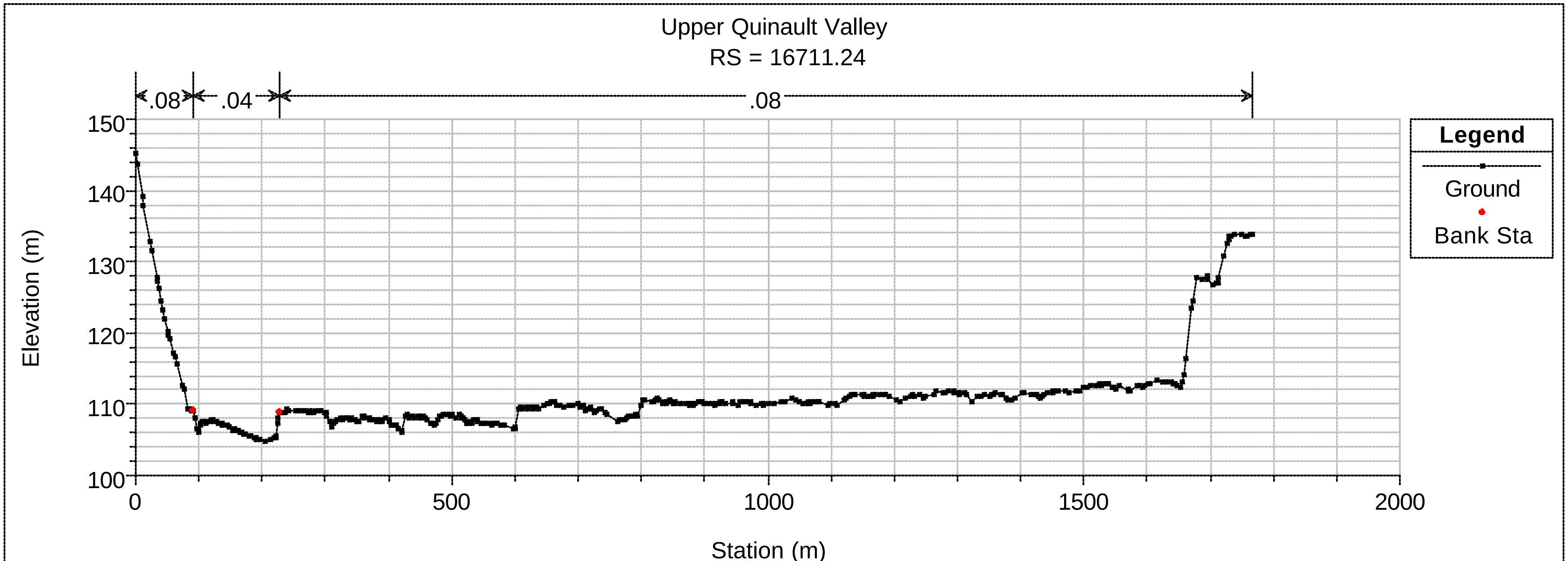
140
135
130
125
120
115
110
105
0
500
1000
1500
2000
Station (m)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.08
.04
.08
Elevation (m)
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140
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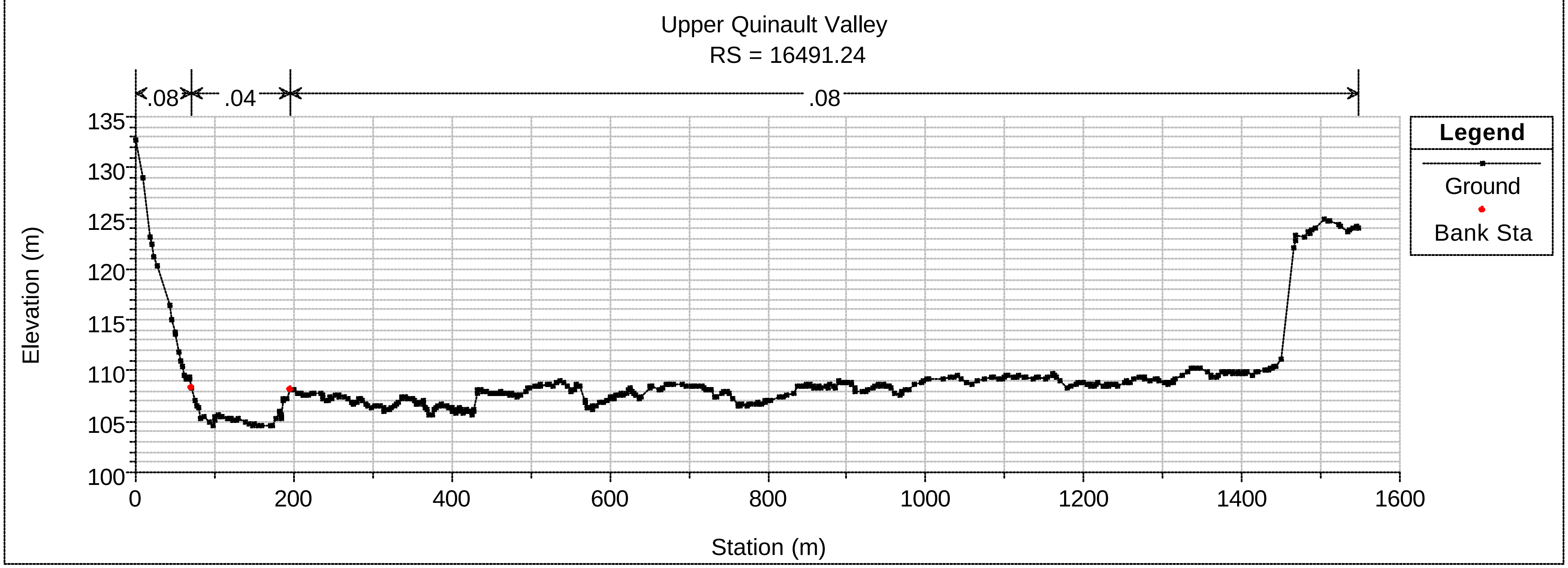
110
100
0
500
1000
1500
2000
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
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.08
.04
.08
Elevation (m)
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130
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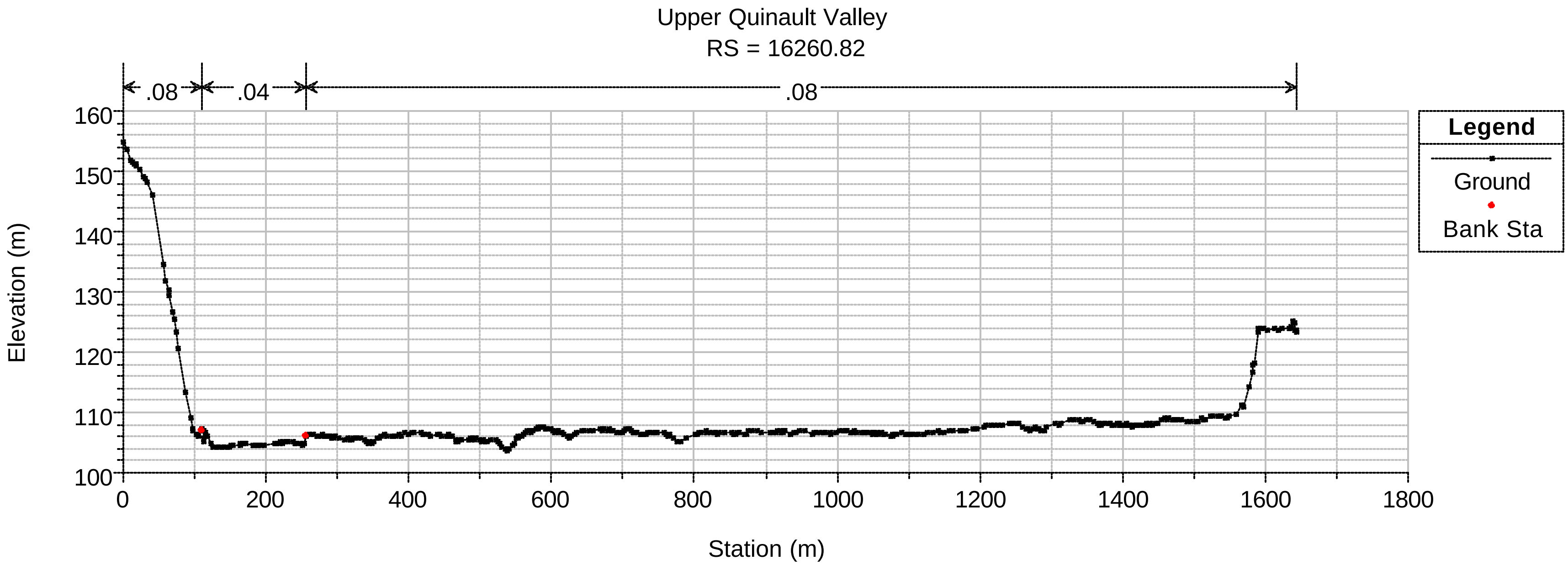
0
200
400
600
800
1000
1200
1400
1600
Station (m)
Legend
Ground
Bank Sta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.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta
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130
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150
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0
200
400
600
800
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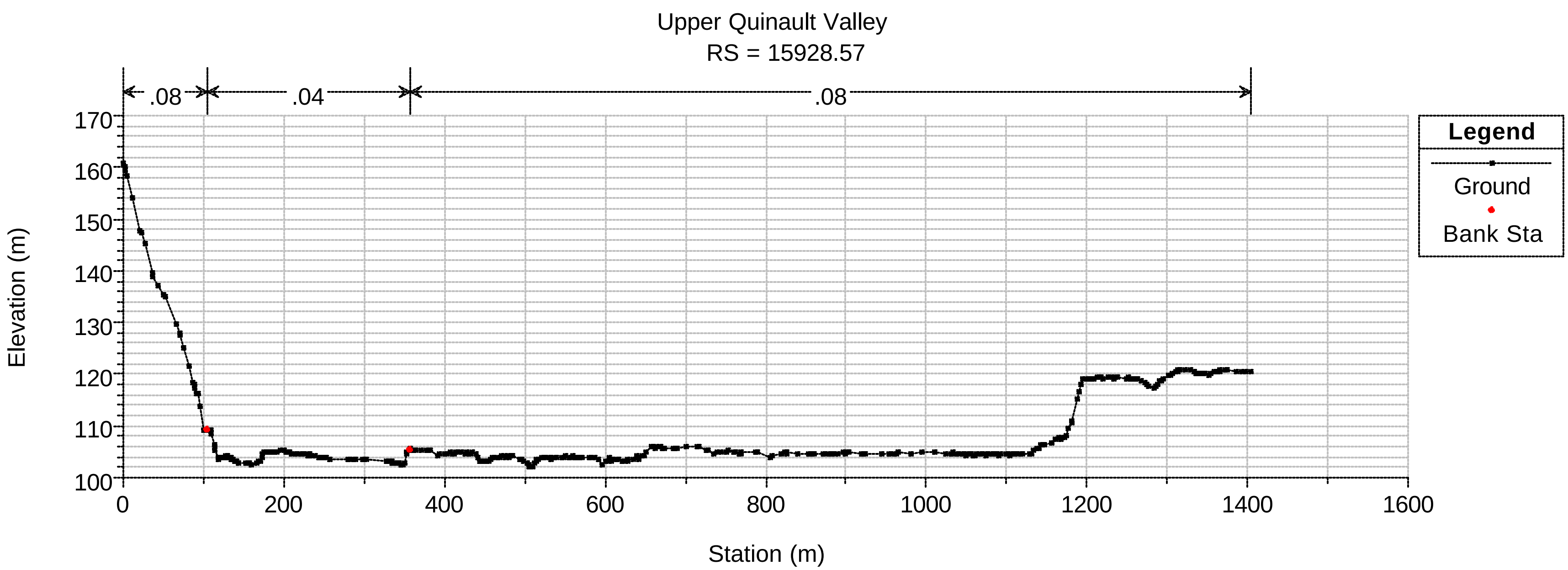
1200
1400
1600
1800


Upper Quinault Valley
RS = 15928.57
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta
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120
130
140
150
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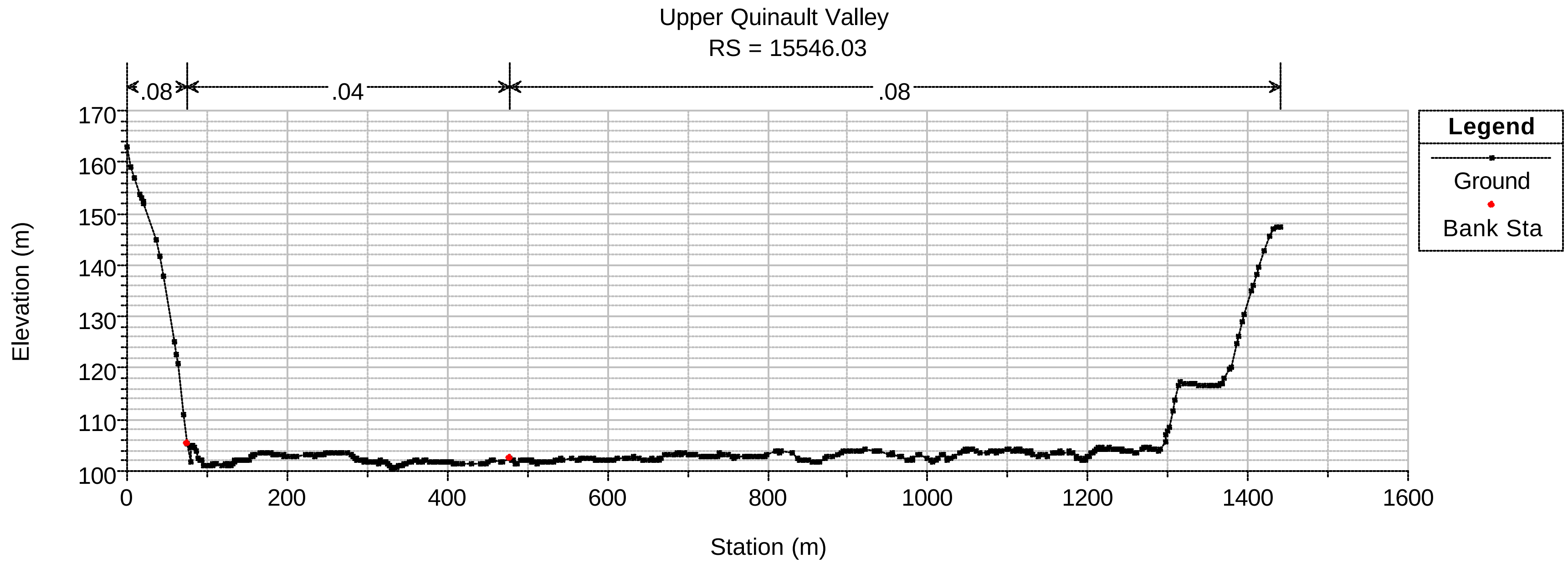
170
0
200
400
600
800
1000
1200
1400
1600



Upper Quinault Valley
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.08
.04
.08
Elevation (m)
170
160
150
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200
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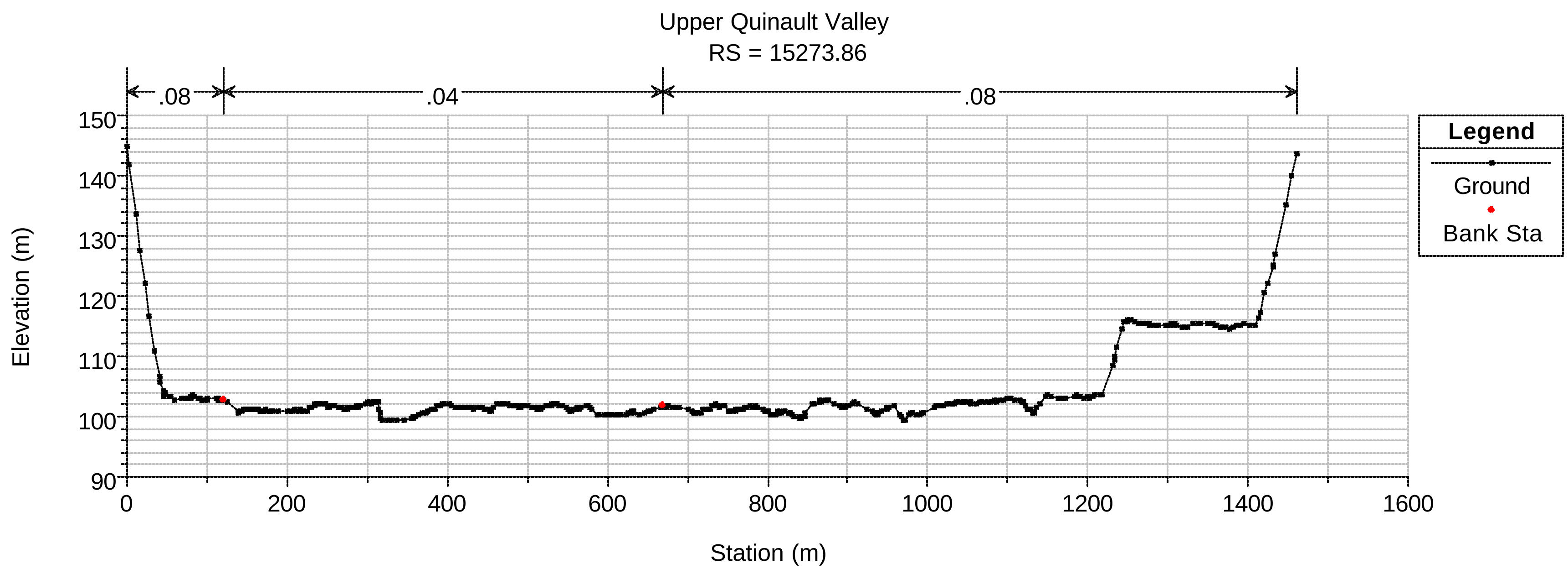
600
800
1000
1200
1400
1600
Station (m)
Legend
Ground
Bank Sta



Upper Quinault Valley
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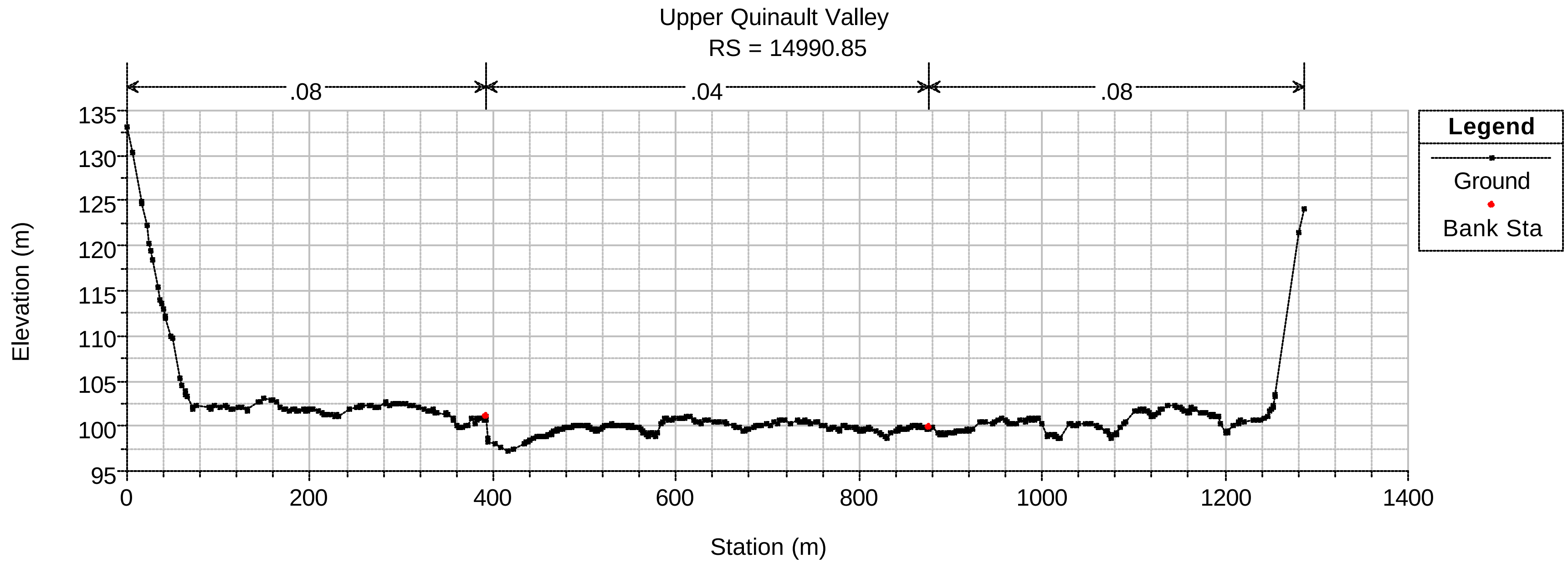
.08
.04
.08
Elevation (m)
150
140
130
120
110
100
90
0
200
400
600
800
1000
1200
1400
1600
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
RS = 14990.85
.08
.04
.08
Elevation (m)
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130
125
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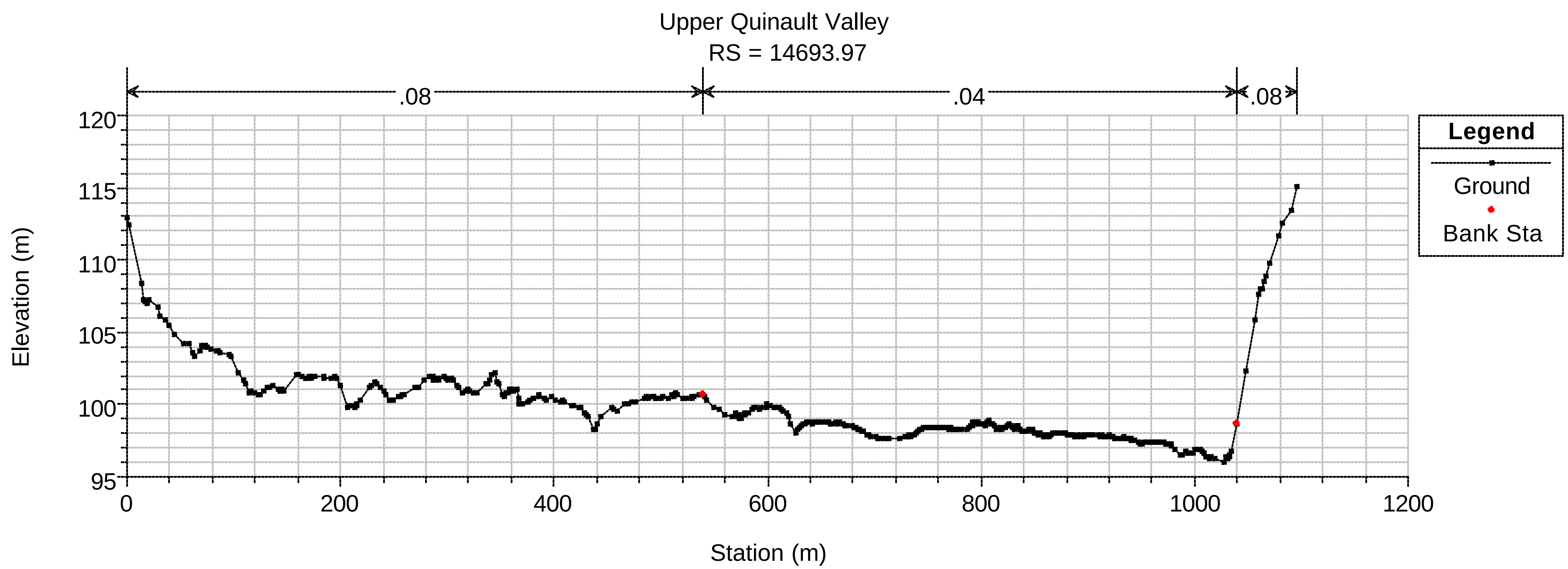
100
95
0
200
400
600
800
1000
1200
1400
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
RS = 14693.97
.08
.04
.08
Elevation (m)
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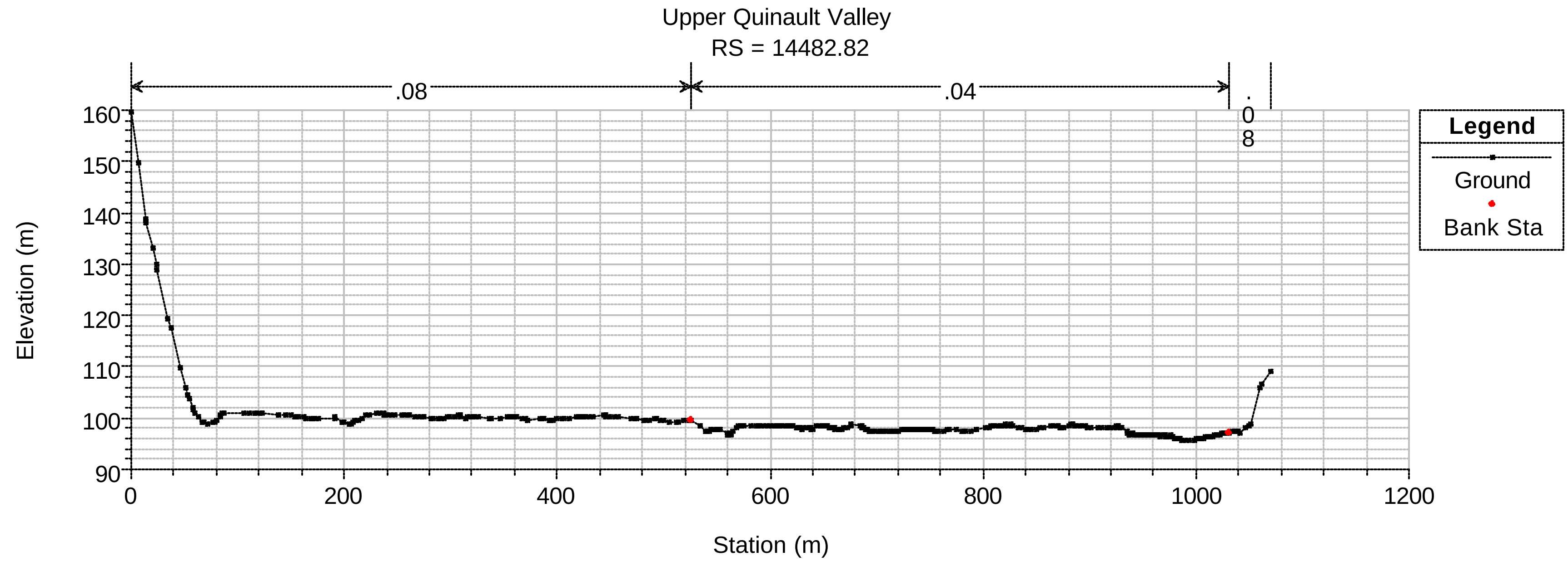
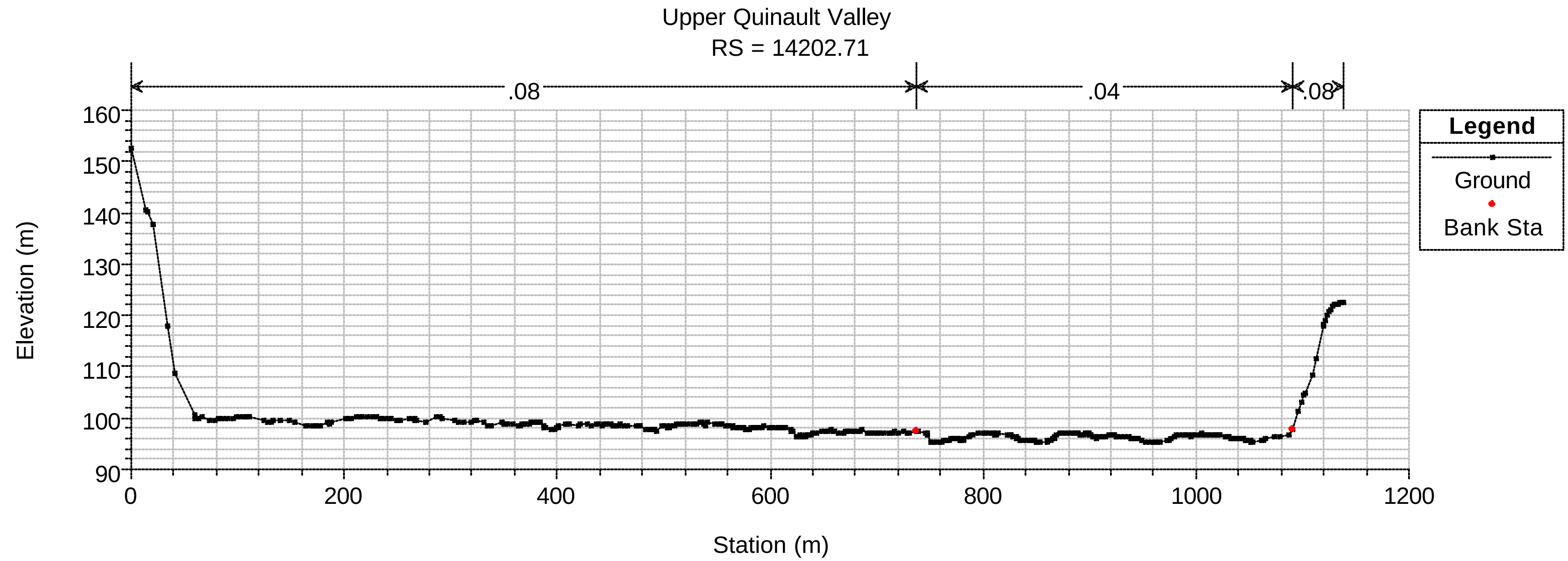
110
105
100
95
0
200
400
600
800
1000
1200
Station (m)
Legend
Ground
Bank Sta



Upper Quinault Valley
RS = 14482.82
.08
.04
.
0
8
Legend
Ground
Bank Sta
Elevation (m)
160
150
140
130
120
110
100
90
0
200
400
600
800
1000
1200
Station (m)



Upper Quinault Valley
RS = 14202.71
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
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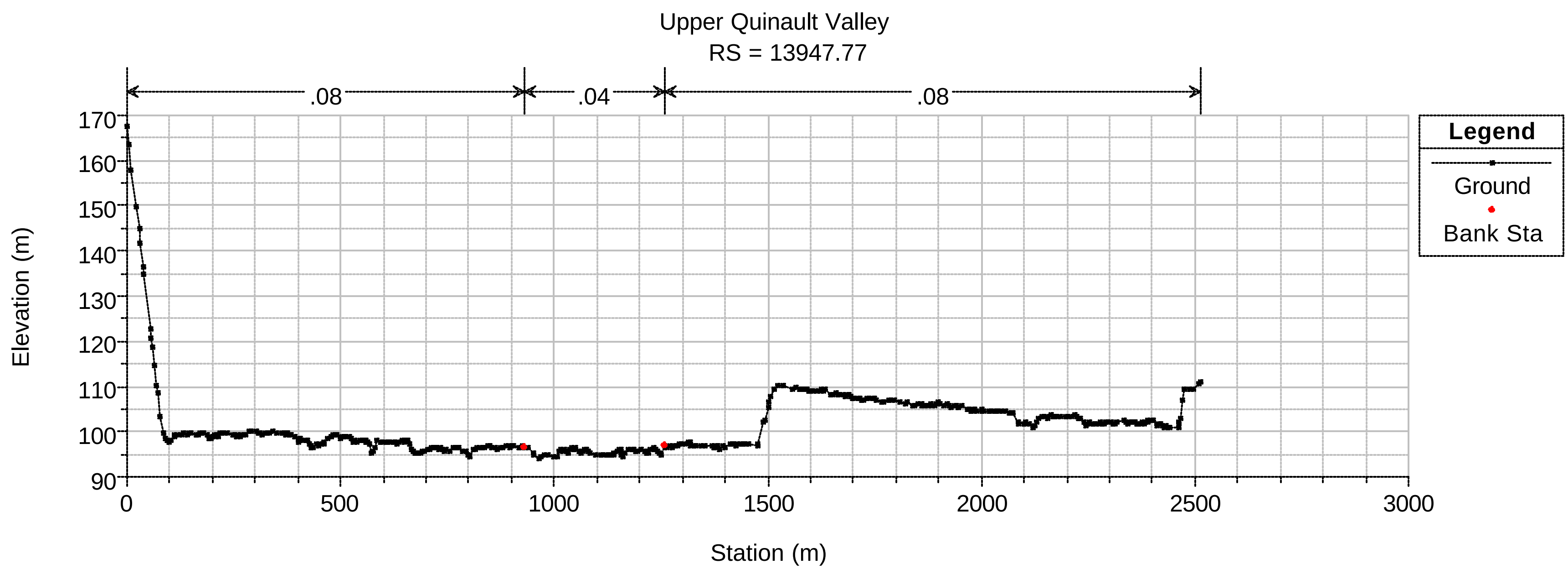
140
130
120
110
100
90
0
200
400
600
800
1000
1200
Station (m)


Upper Quinault Valley
RS = 13947.77
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
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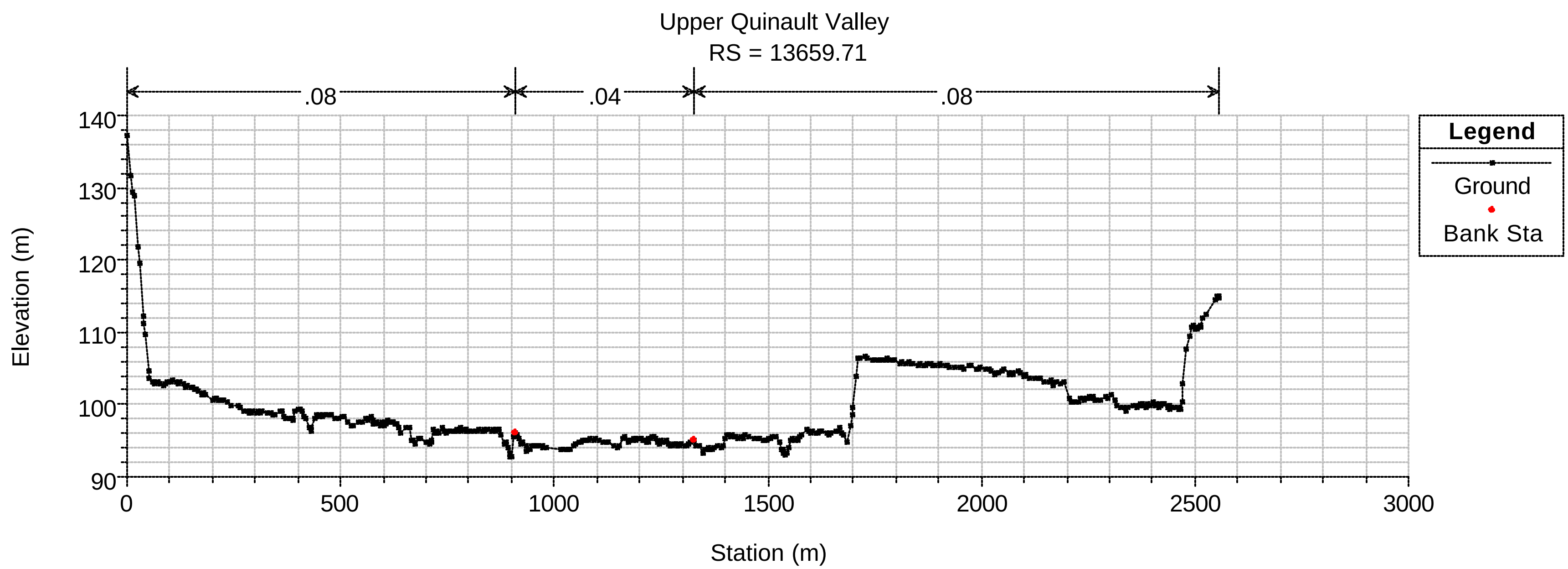
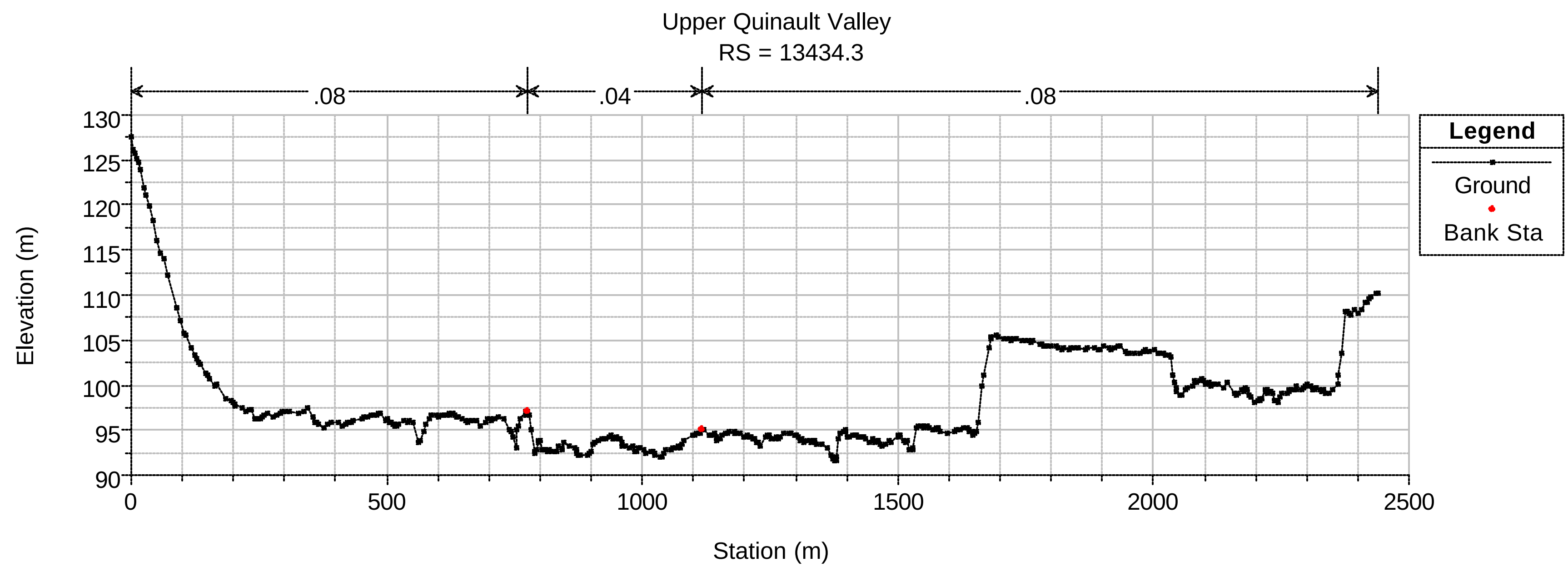
160
150
140
130
120
110
100
90
0
500
1000
1500
2000
2500
3000


Upper Quinault Valley
RS = 13659.71
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
140
130
120
110
100
90
0
500
1000
1500
2000
2500
3000



Upper Quinault Valley
RS = 13434.3
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
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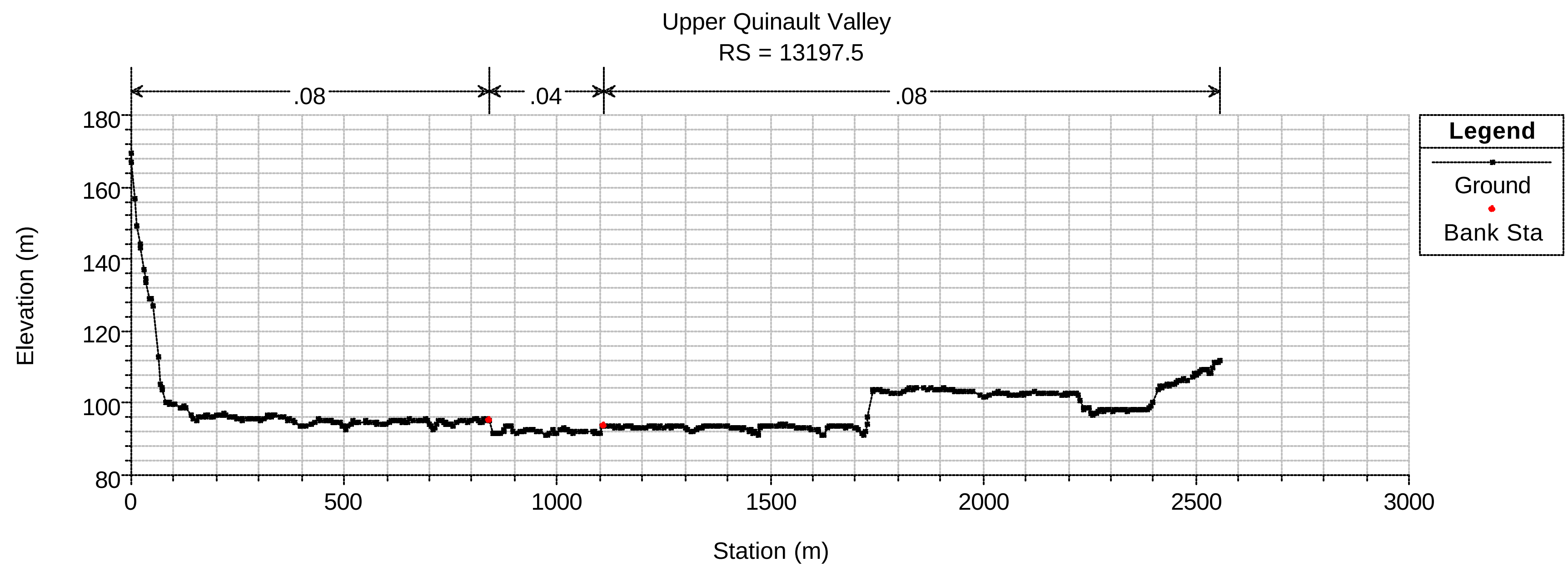
90
0
500
1000
1500
2000
2500
Station (m)



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.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
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80
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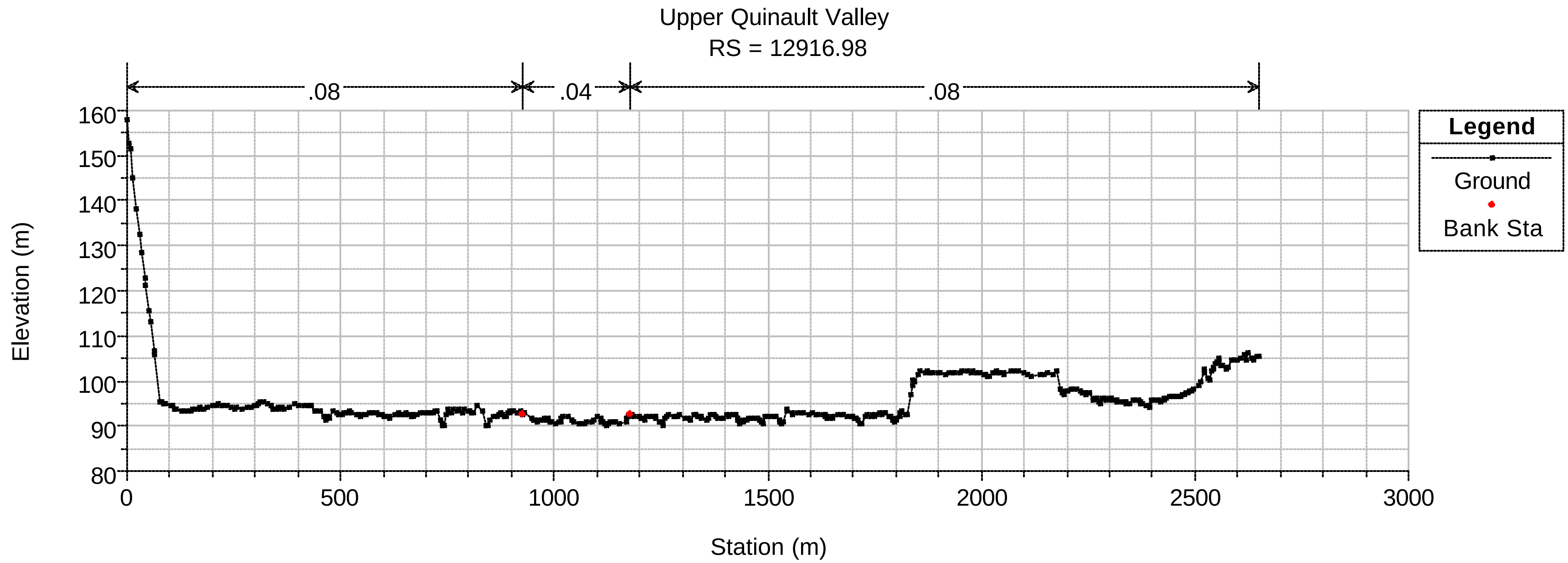
500
1000
1500
2000
2500
3000
Station (m)



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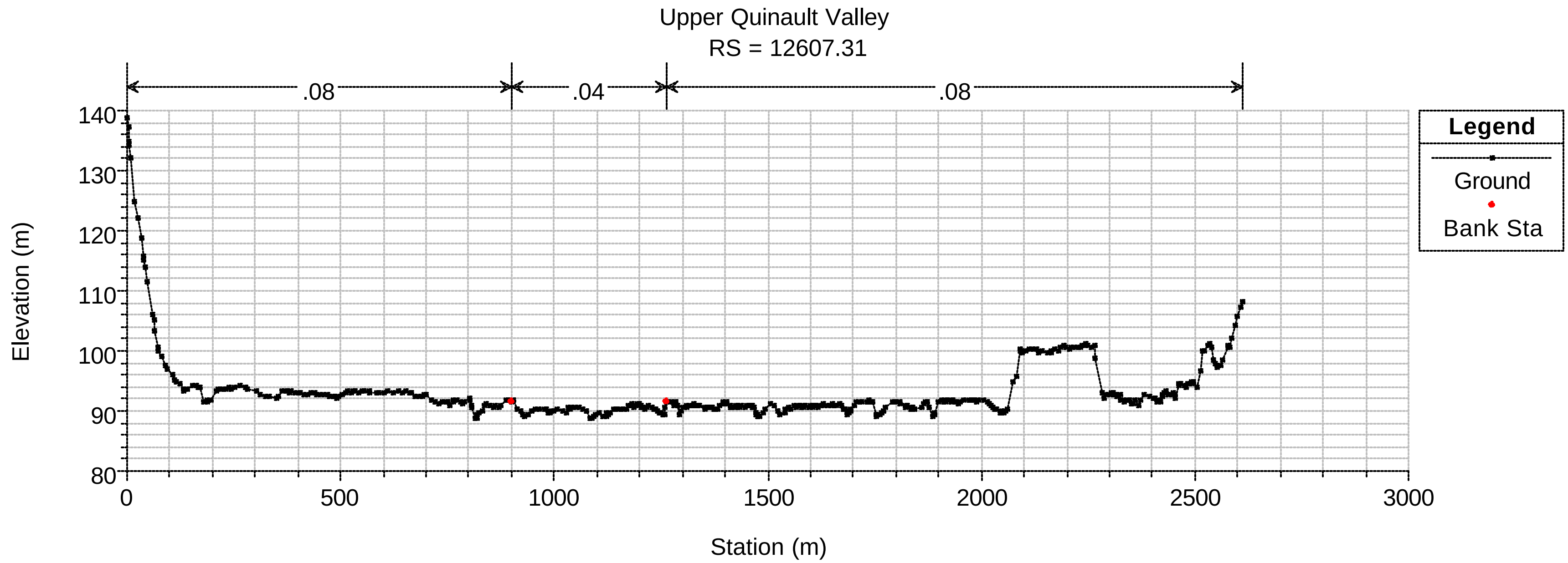
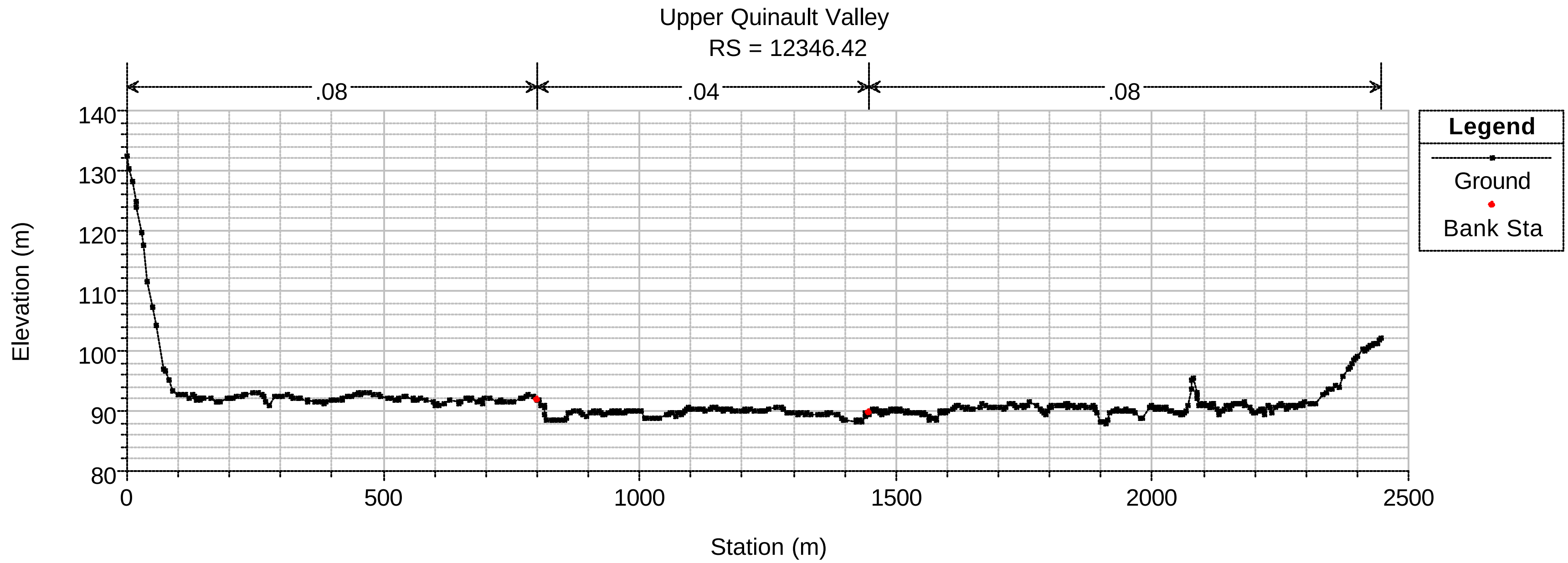
RS = 12916.98
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta



Upper Quinault Valley
RS = 12607.31
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta



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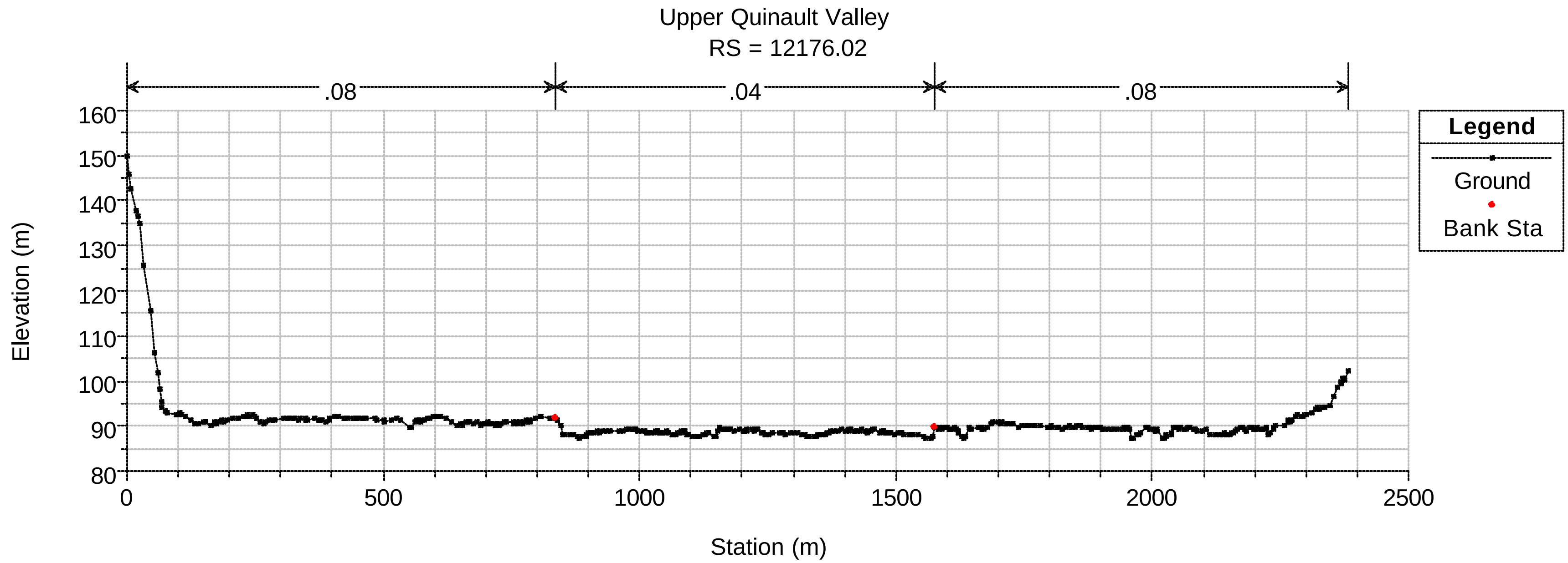
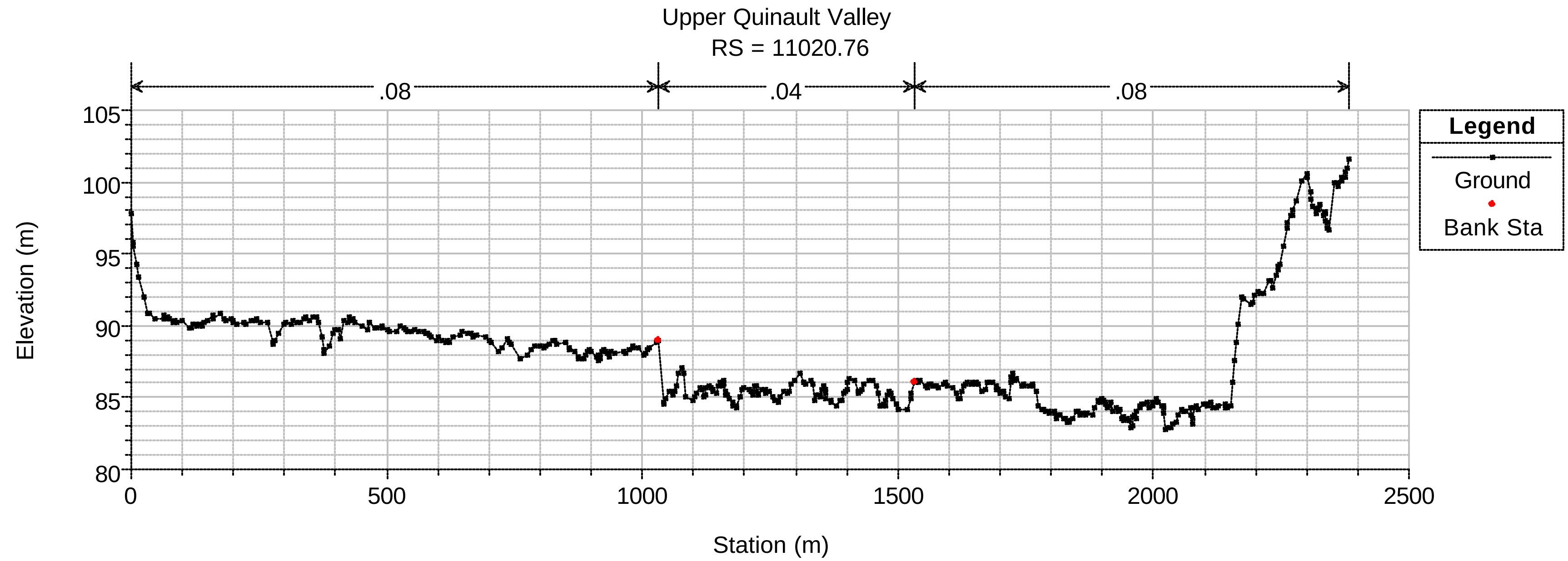
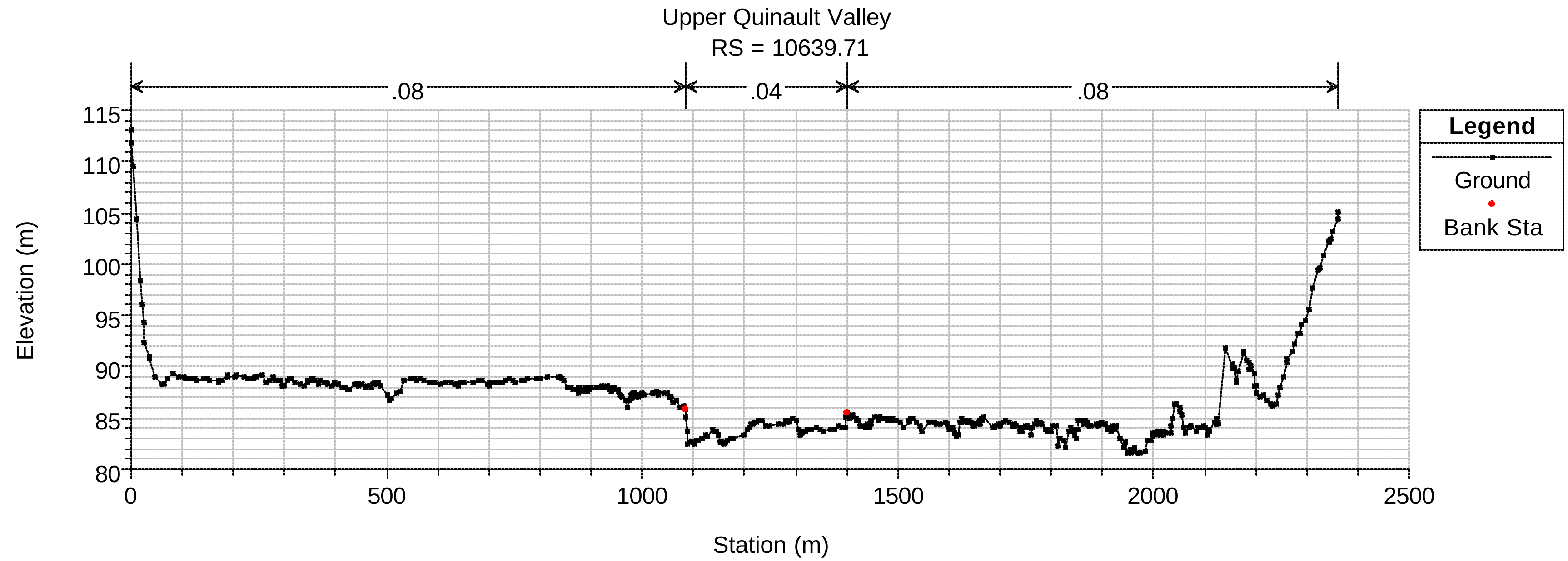
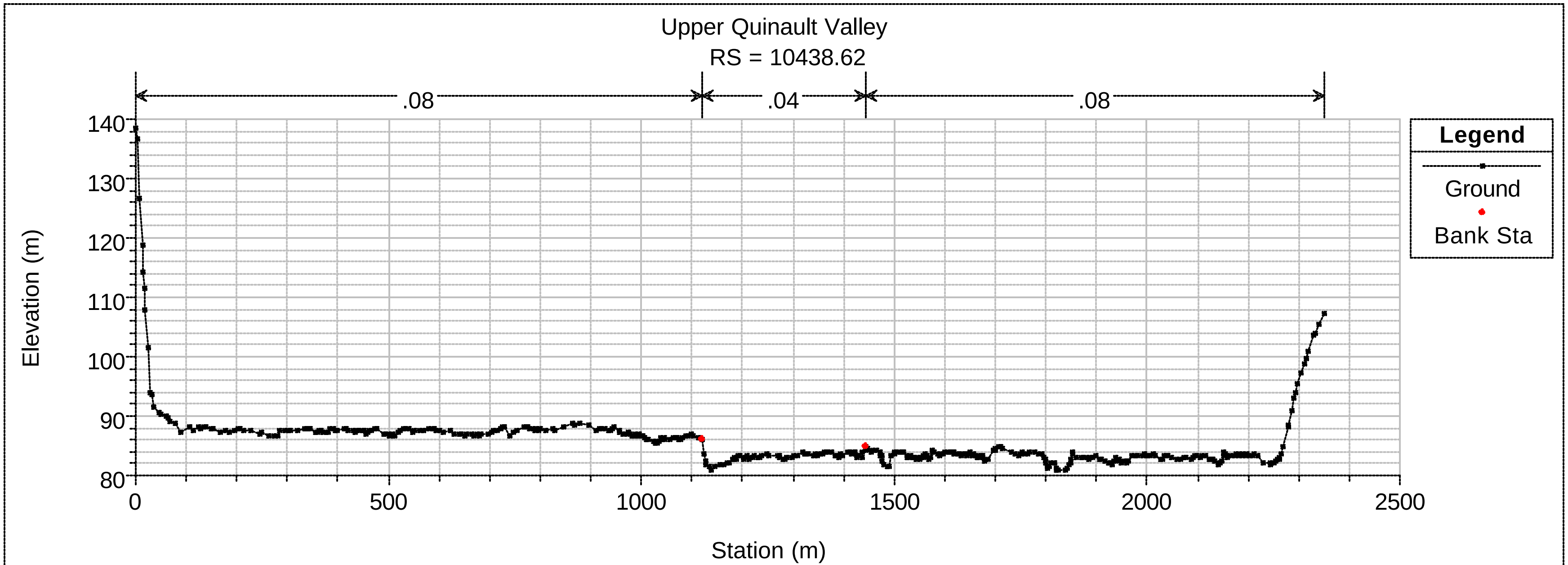
RS = 12346.42
.08
.04
.08
Elevation (m)
140
130
120
110
100
90
80
0
500
1000
1500
2000
2500
Station (m)
Legend
Ground
Bank Sta

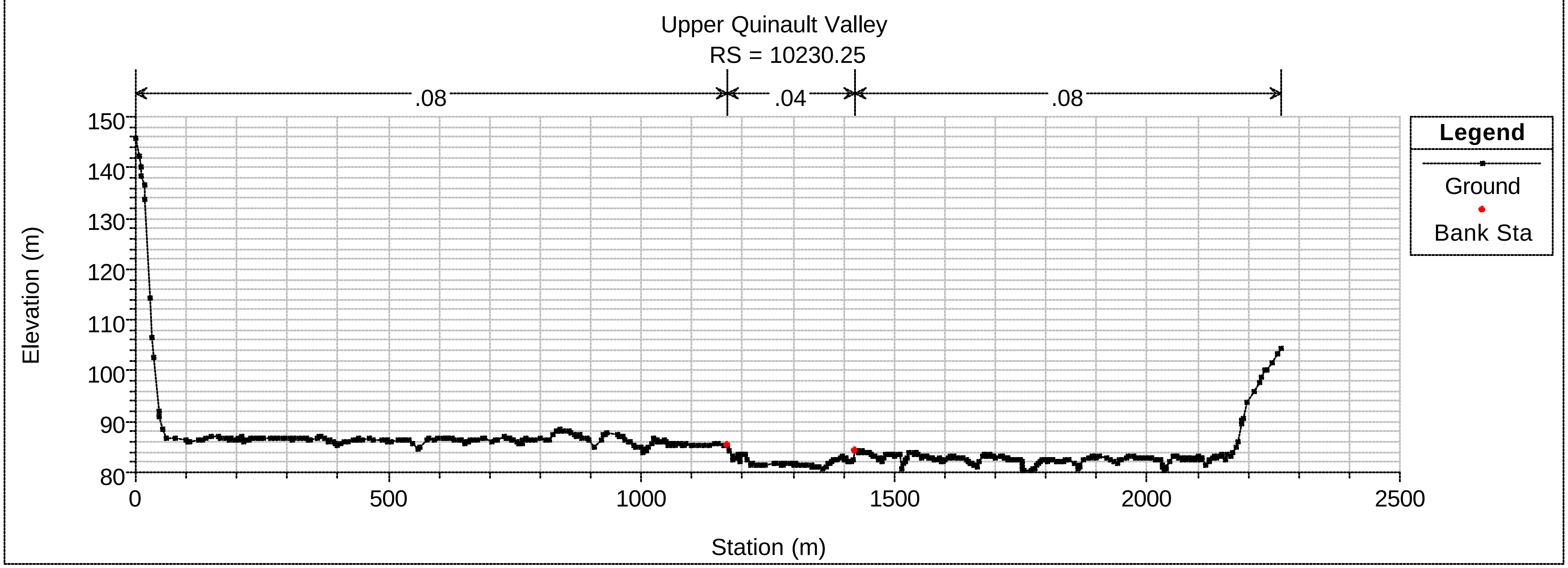


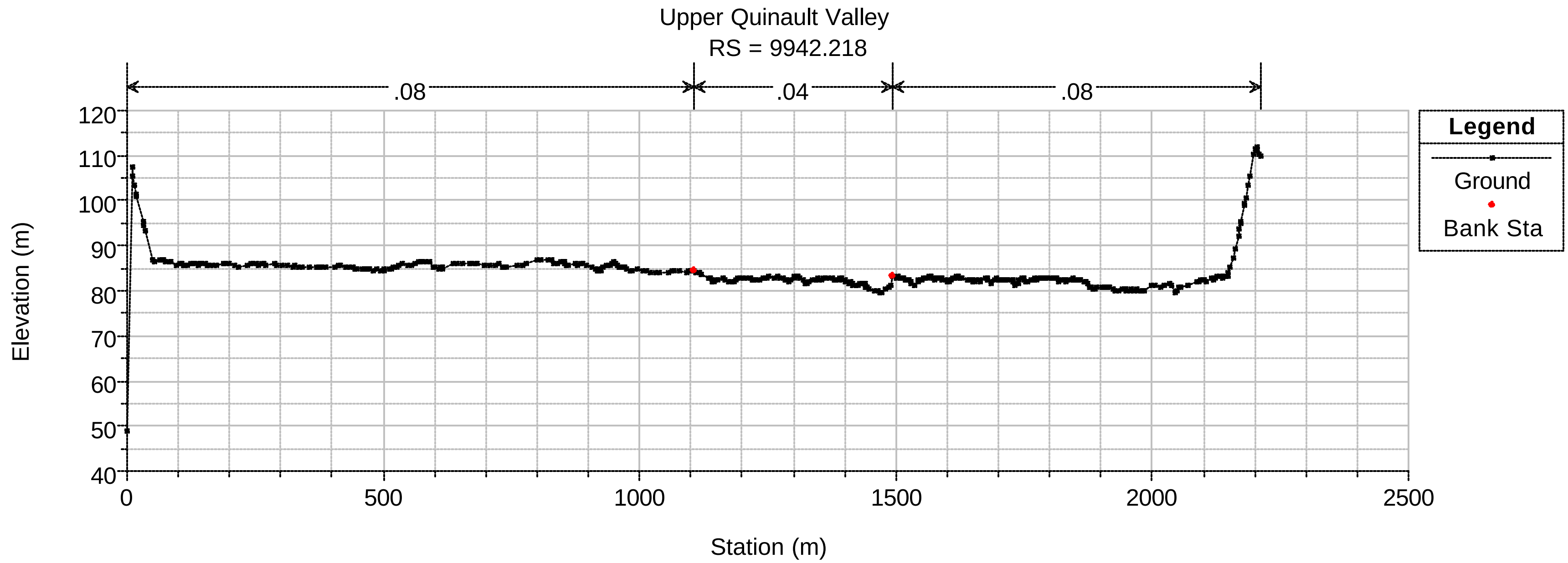
Upper Quinault Valley
RS = 12176.02
.08
.04
.08
Elevation (m)
160
150
140
130
120
110
100
90
80
0
500
1000
1500
2000
2500
Station (m)
Legend
Ground
Bank Sta

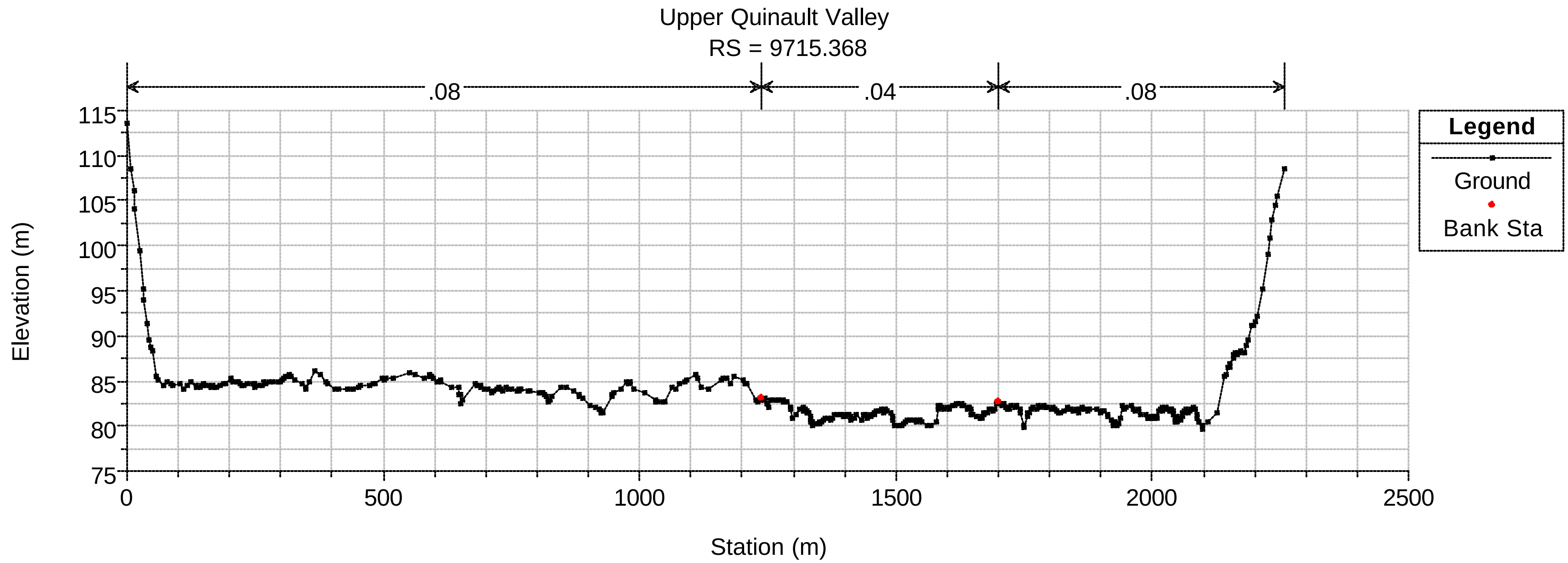

Upper Quinault Valley
RS = 11020.76
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
105
100
95
90
85
80
0
500
1000
1500
2000
2500

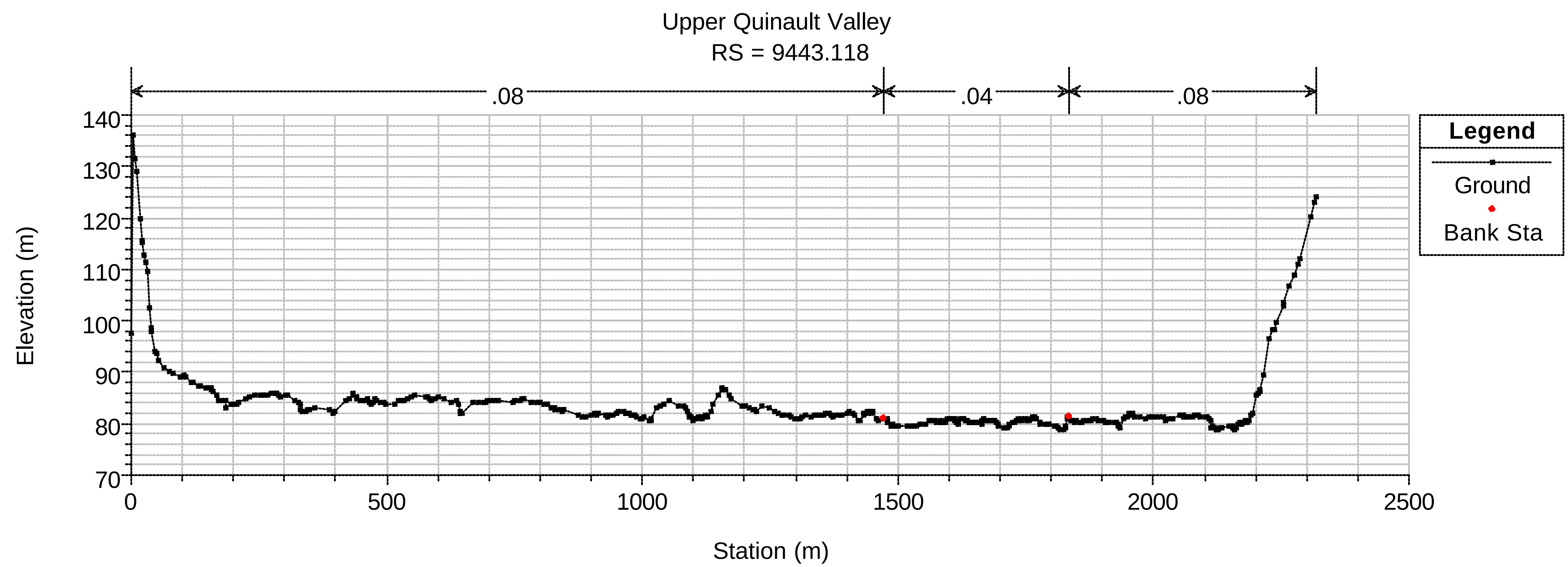

Upper Quinault Valley
RS = 10639.71
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
115
110
105
100
95
90
85
80
0
500
1000
1500
2000
2500

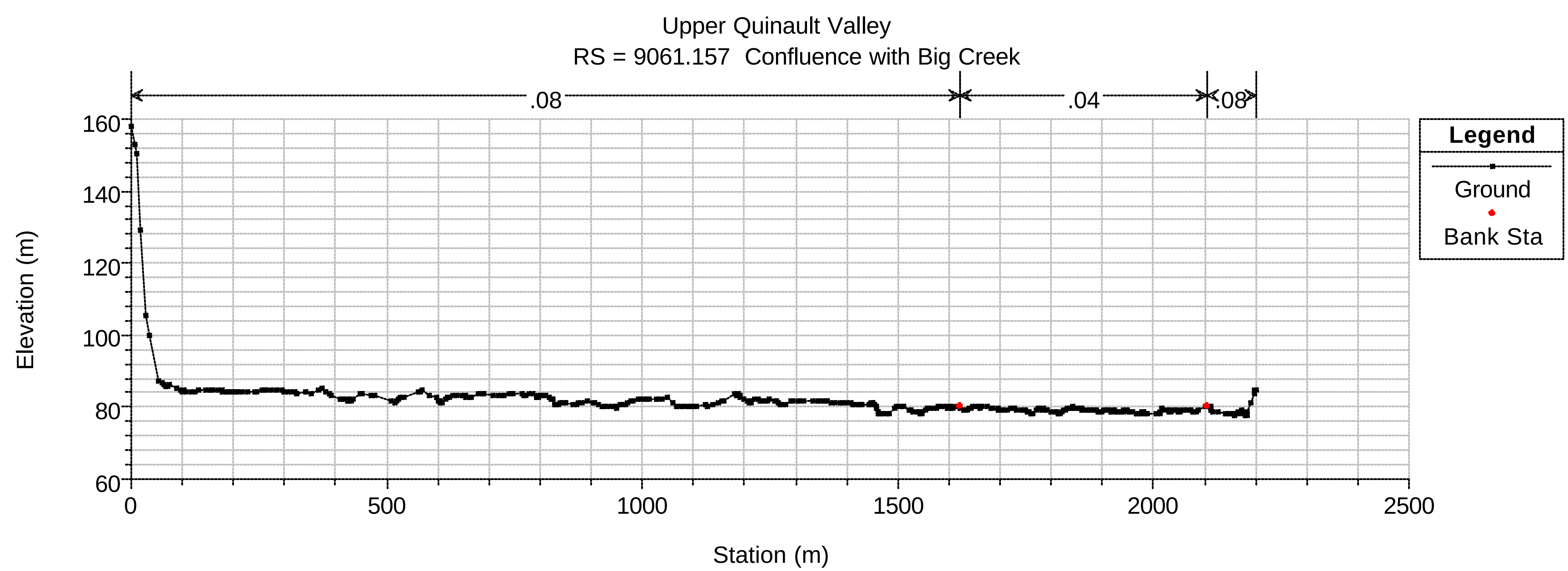

Upper Quinault Valley
RS = 10438.62
.08
.04
.08
Elevation (m)
140
130
120
110
100
90
80
0
500
1000
1500
2000
2500
Station (m)
Legend
Ground
Bank Sta

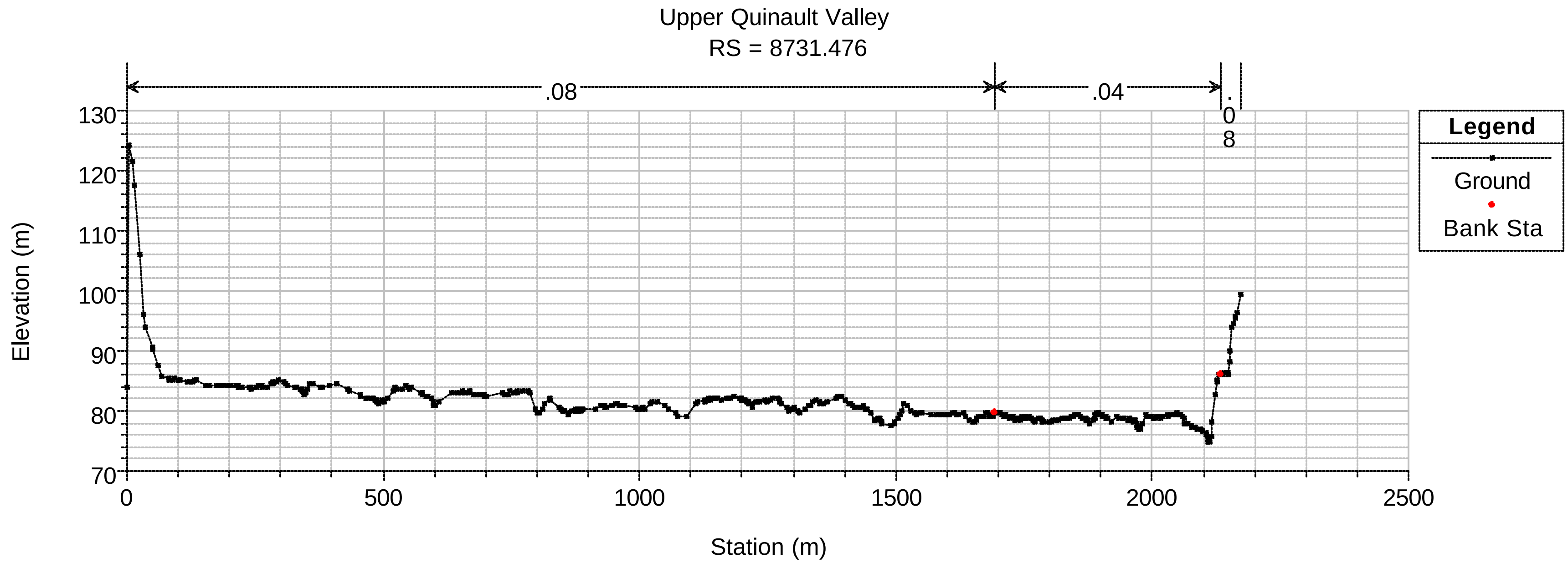

Upper Quinault Valley
RS = 10230.25
.08
.04
.08
Elevation (m)
150
140
130
120
110
100
90
80
0
500
1000
1500
2000
2500
Station (m)
Legend
Ground
Bank Sta

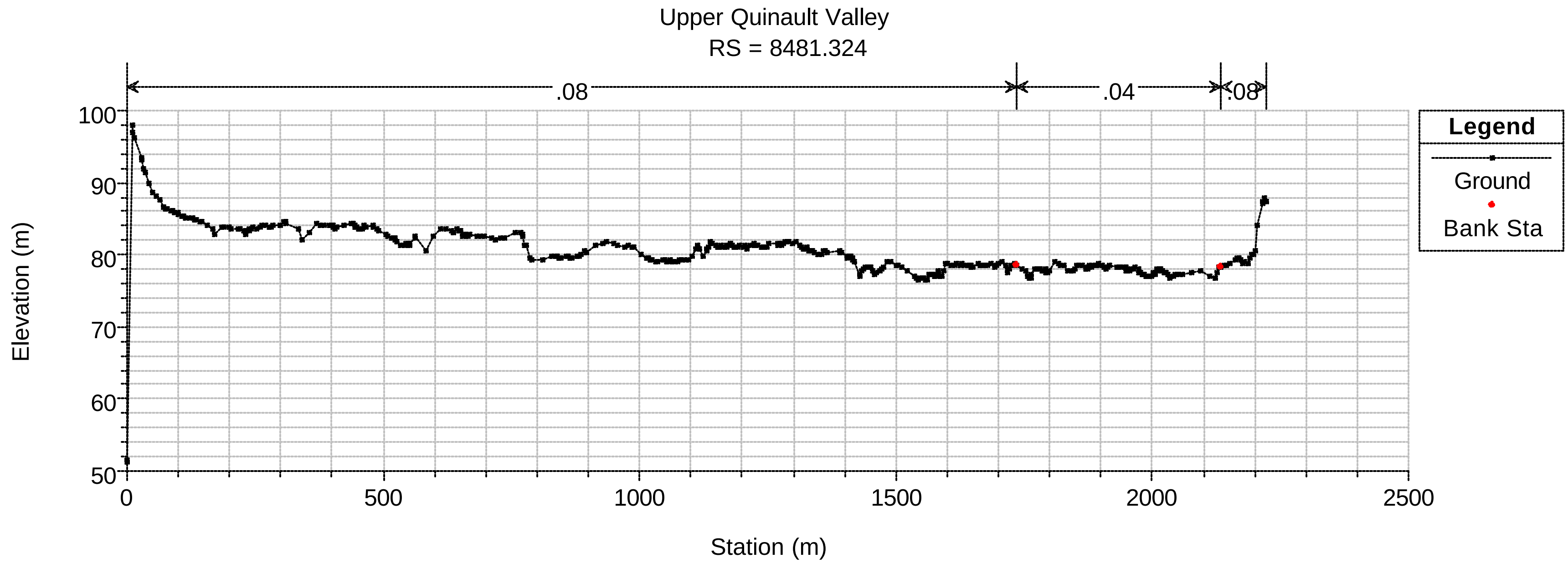

Upper Quinault Valley
RS = 9942.218
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
120
110
100
90
80
70
60
50
40
0
500
1000
1500
2000
2500

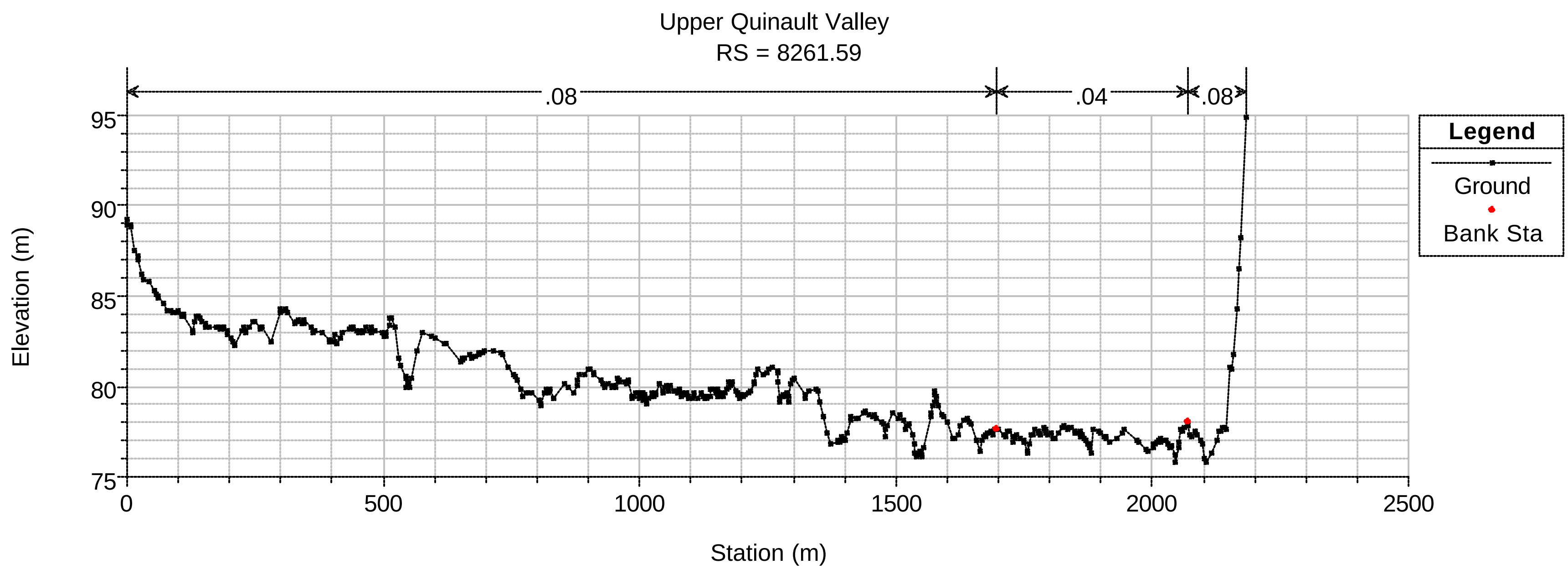

Upper Quinault Valley
RS = 9715.368
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
115
110
105
100
95
90
85
80
75
0
500
1000
1500
2000
2500

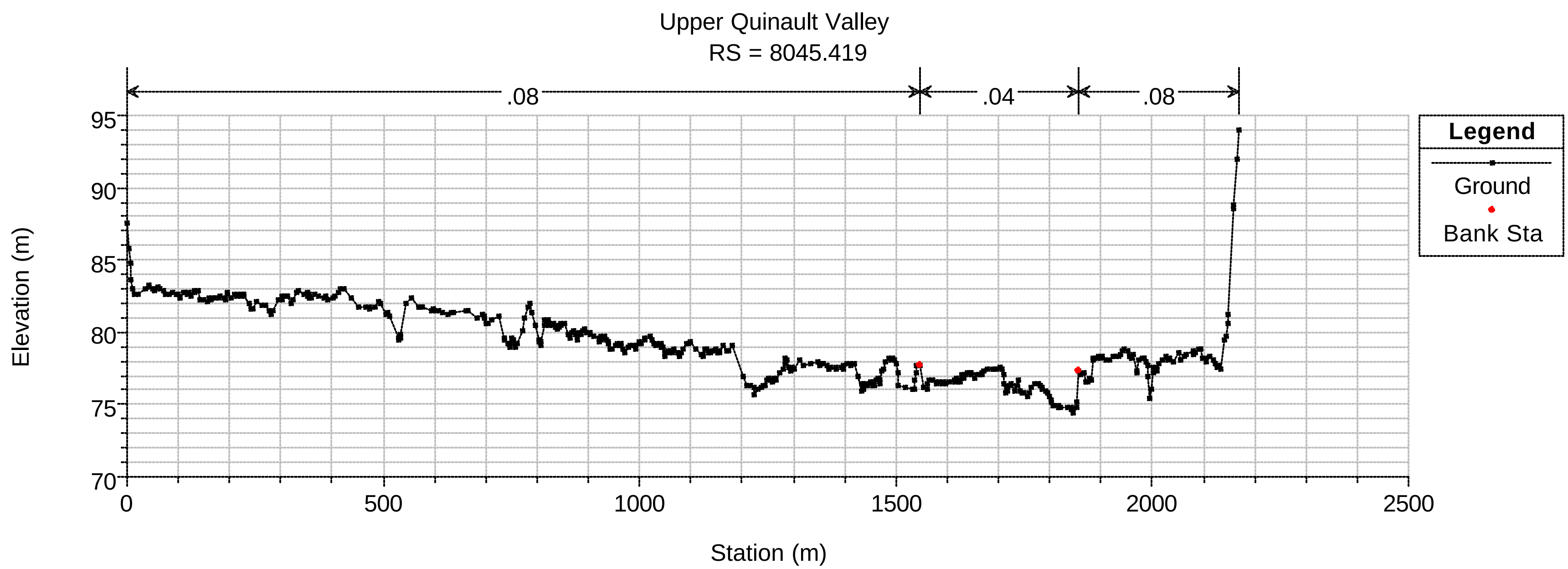

Upper Quinault Valley
RS = 9443.118
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
140
130
120
110
100
90
80
70
0
500
1000
1500
2000
2500
Station (m)

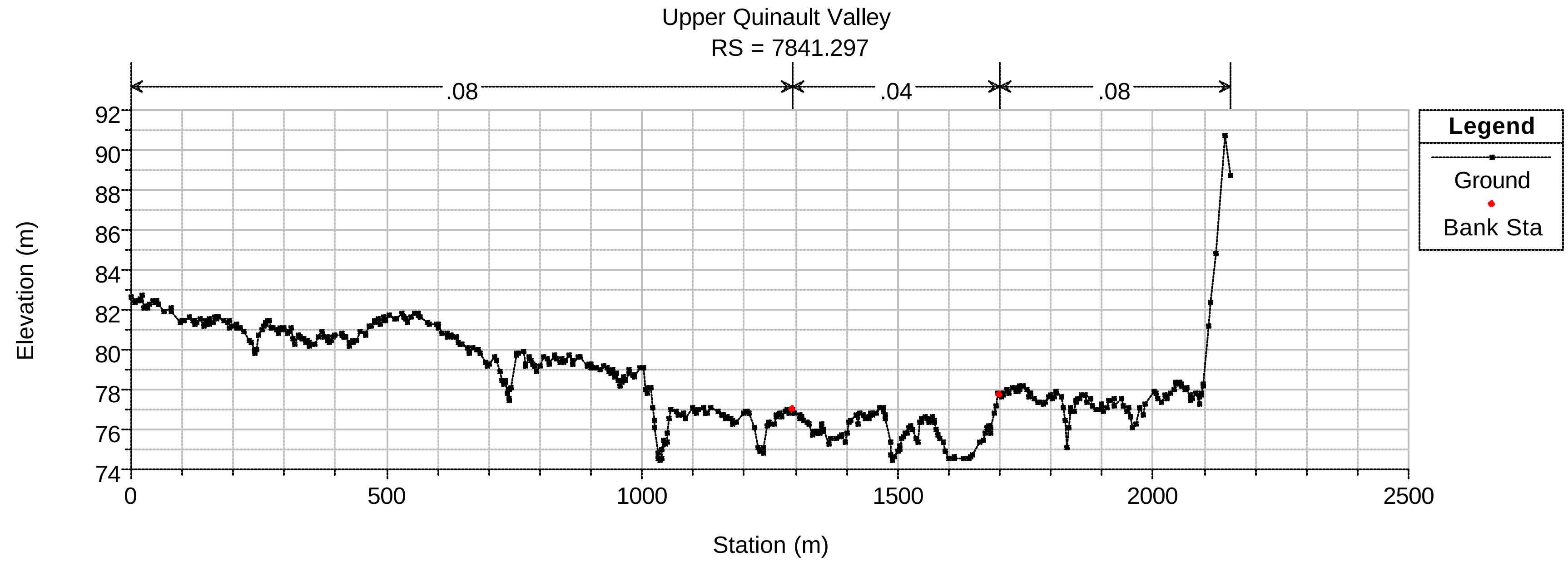

Upper Quinault Valley
RS = 9061.157 Confluence with Big Creek
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
160
140
120
100
80
60
0
500
1000
1500
2000
2500
Station (m)

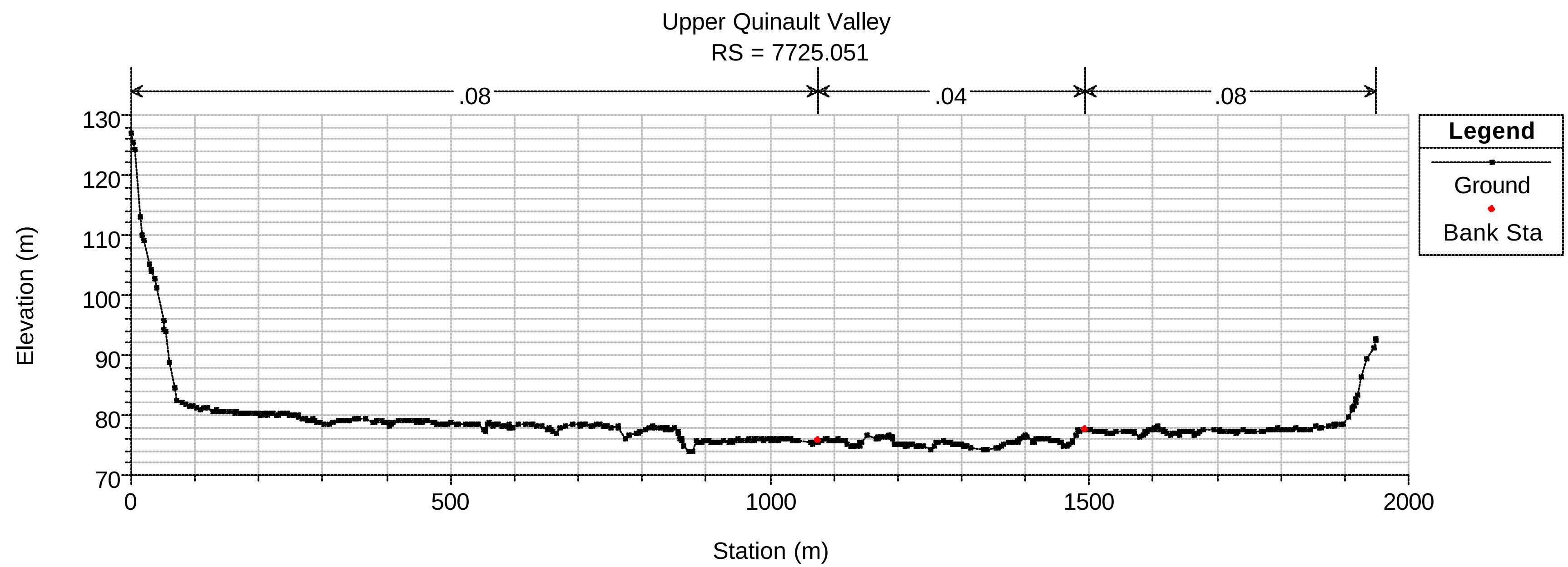

Upper Quinault Valley
RS = 8731.476
.08
.04
.
0
8
Legend
Ground
Bank Sta
Elevation (m)
130
120
110
100
90
80
70
0
500
1000
1500
2000
2500
Station (m)

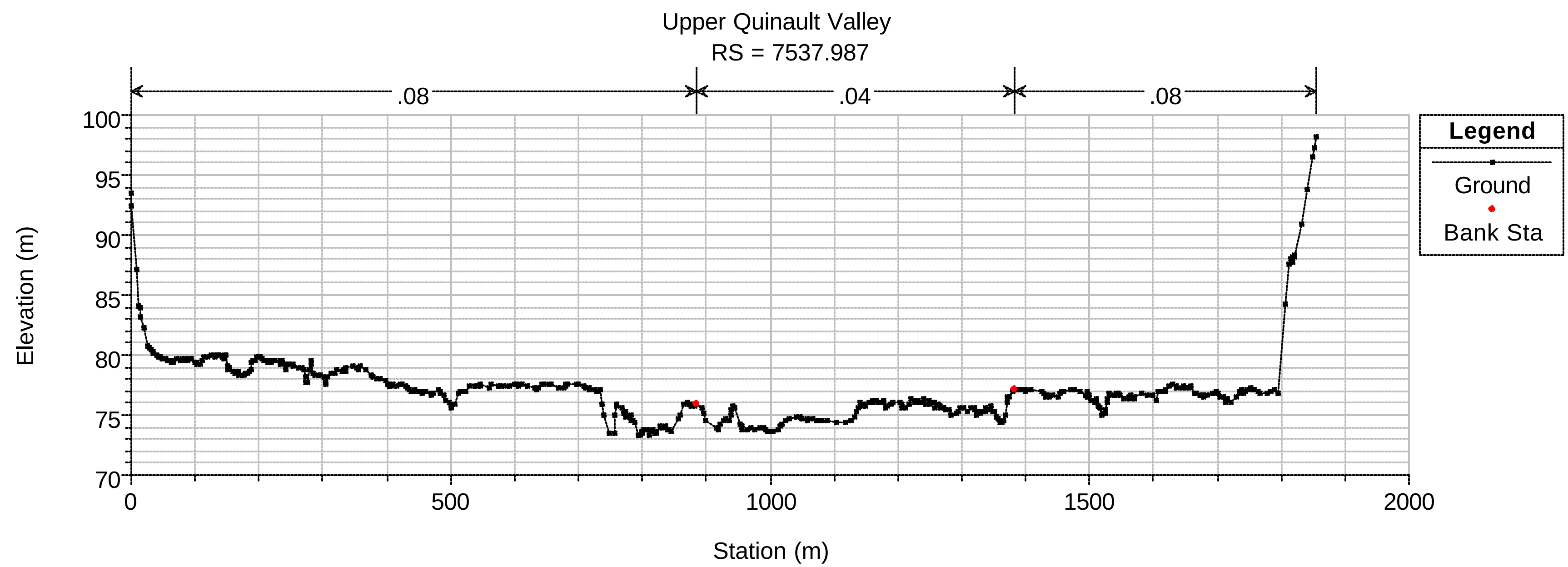

Upper Quinault Valley
RS = 8481.324
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
100
90
80
70
60
50
0
500
1000
1500
2000
2500
Station (m)

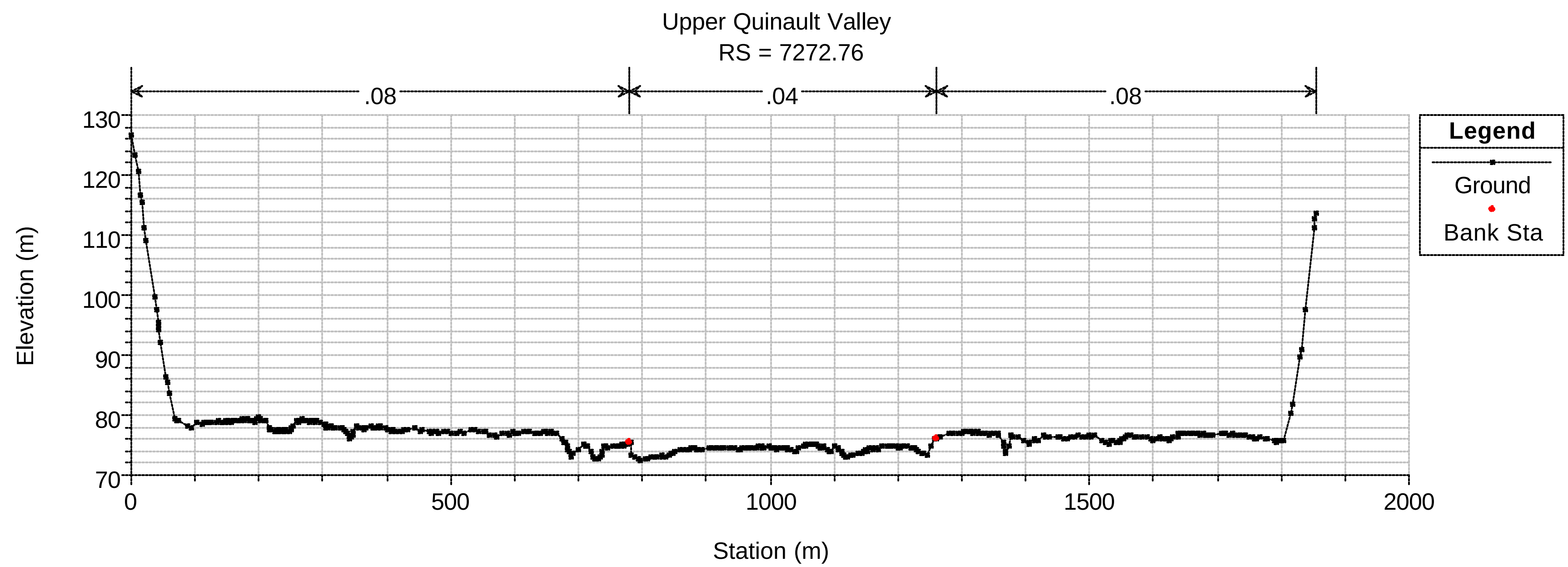

Upper Quinault Valley
RS = 8261.59
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta

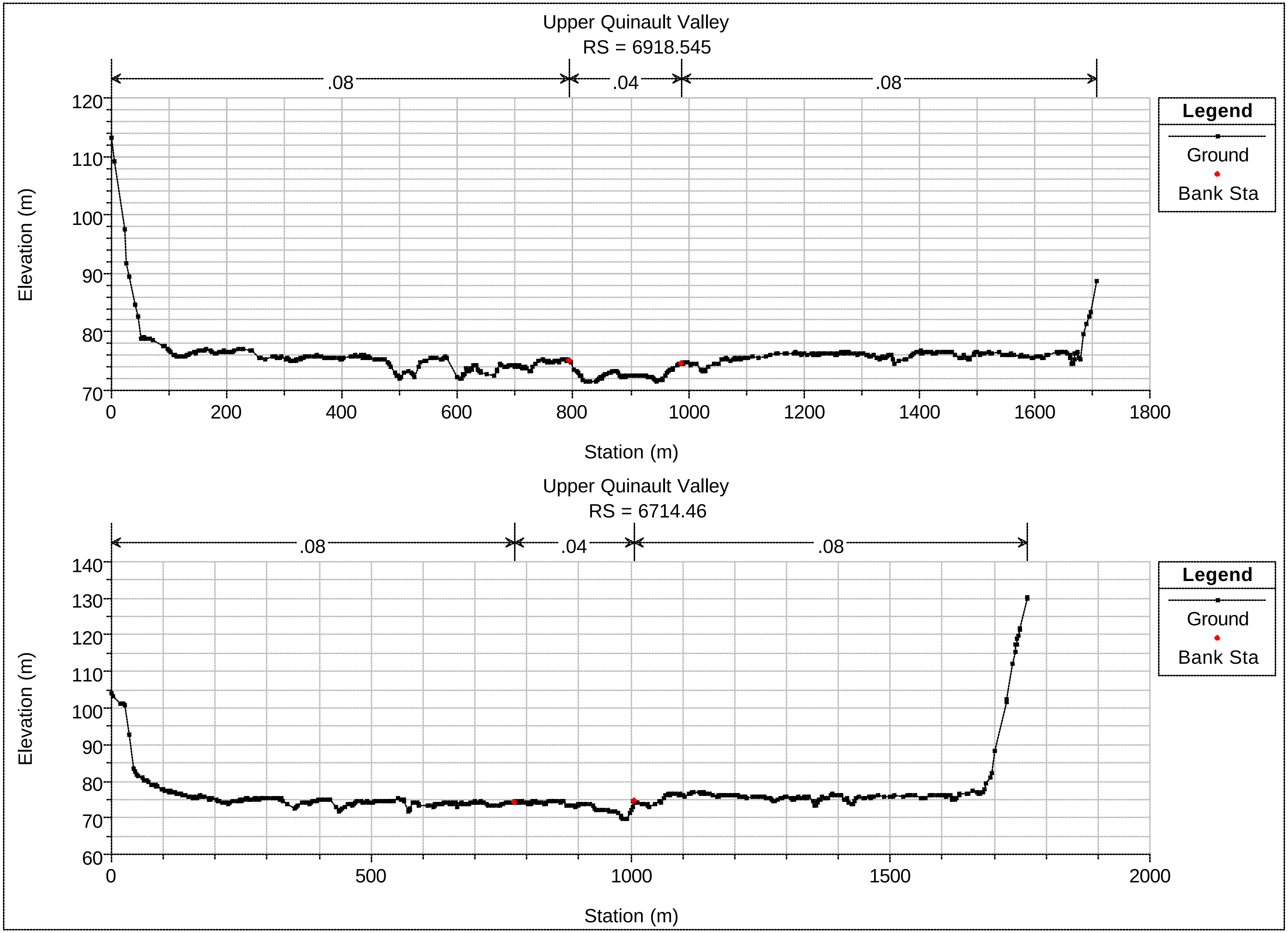

Upper Quinault Valley
RS = 8045.419
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
RS = 7841.297
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
92
90
88
86
84
82
80
78
76
74
0
500
1000
1500
2000
2500
Station (m)

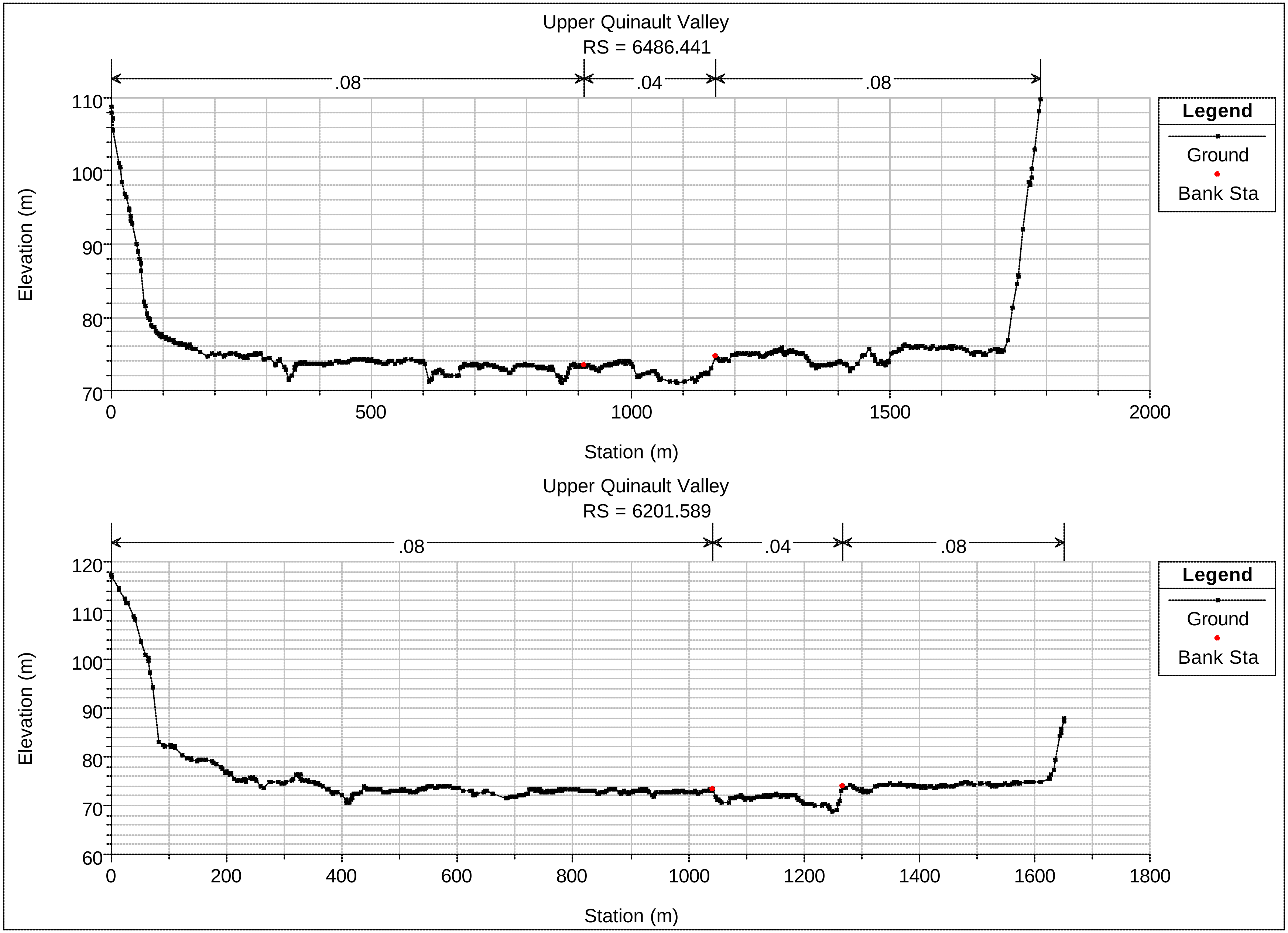

Upper Quinault Valley
RS = 7725.051
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
130
120
110
100
90
80
70
0
500
1000
1500
2000
Station (m)

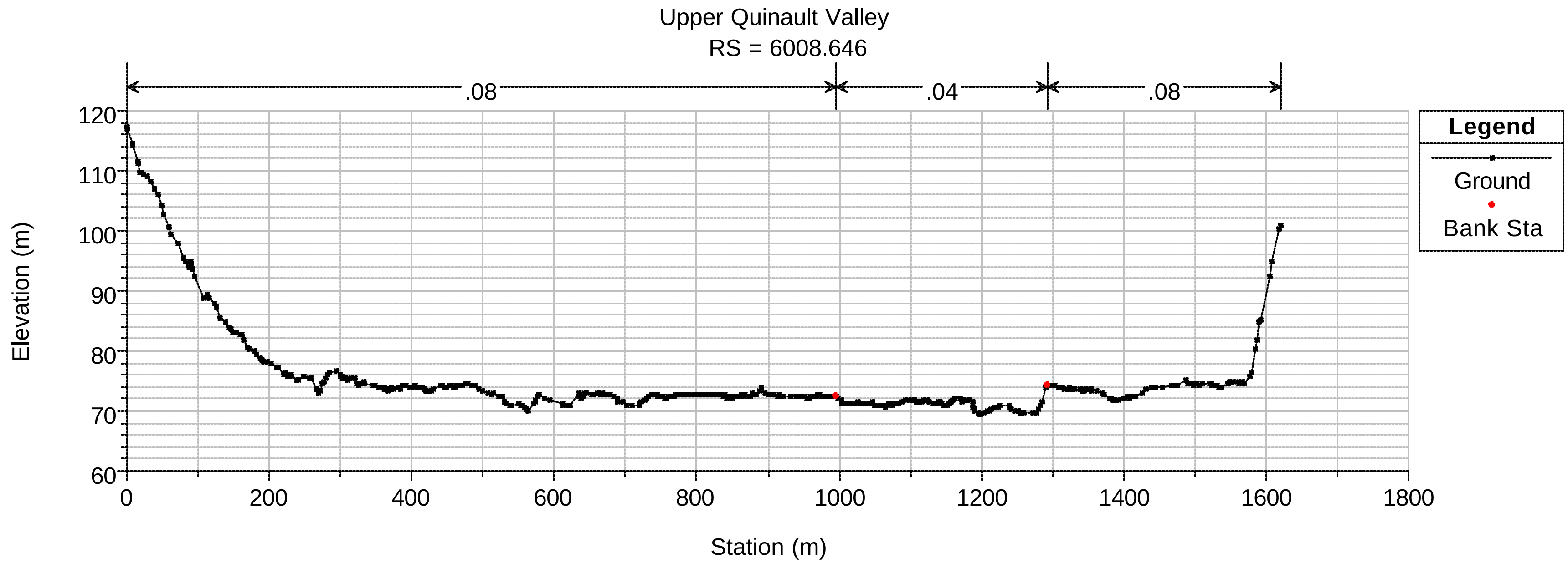

Upper Quinault Valley
RS = 7537.987
.08
.04
.08
Elevation (m)
100
95
90
85
80
75
70
0
500
1000
1500
2000
Station (m)
Legend
Ground
Bank Sta

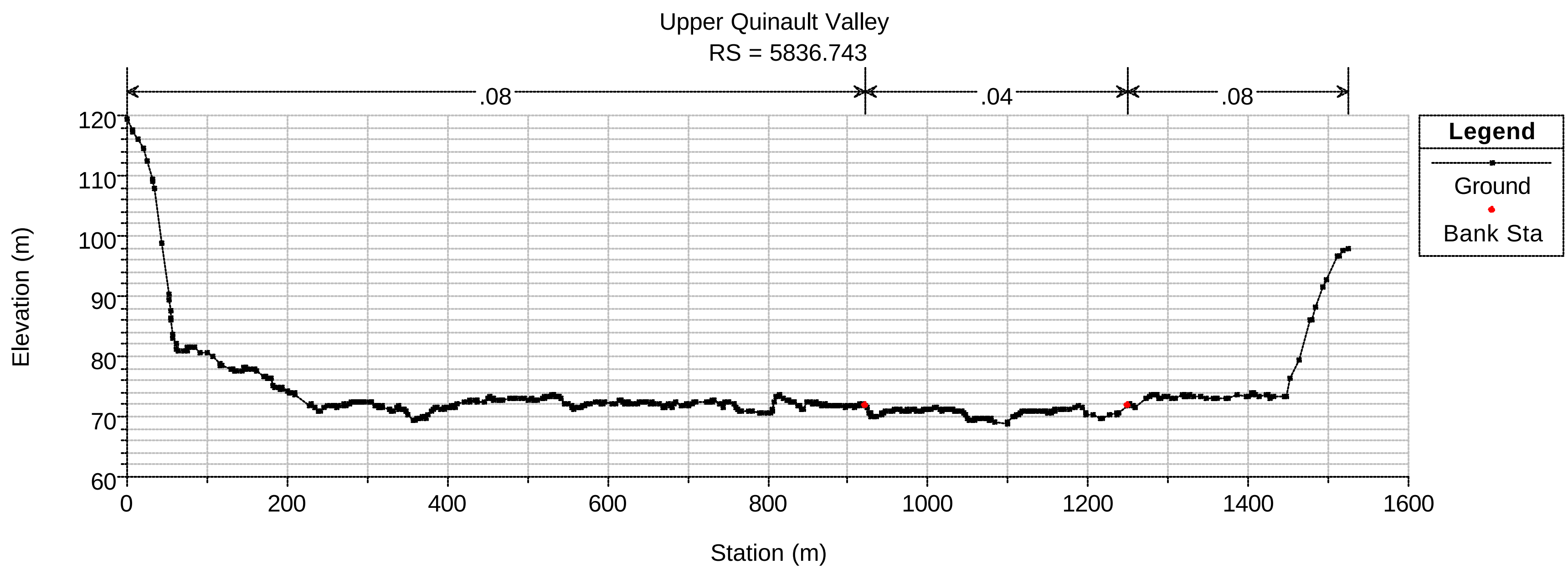

Upper Quinault Valley
RS = 7272.76
.08
.04
.08
Elevation (m)
130
120
110
100
90
80
70
0
500
1000
1500
2000
Station (m)
Legend
Ground
Bank Sta

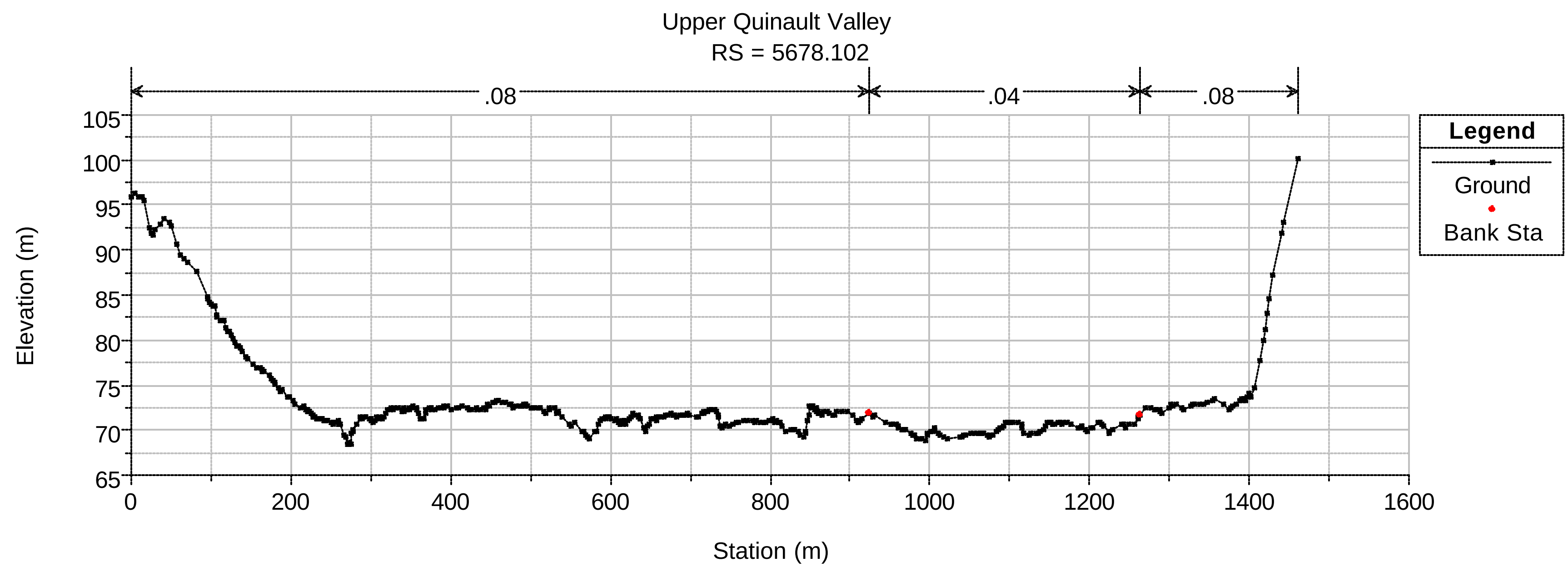


Upper Quinault Valley
RS = 6918.545
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
120
110
100
90
80
70
0
200
400
600
800
1000
1200
1400
1600
1800
Upper Quinault Valley
RS = 6714.46
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
140
130
120
110
100
90
80
70
60
0
500
1000
1500
2000

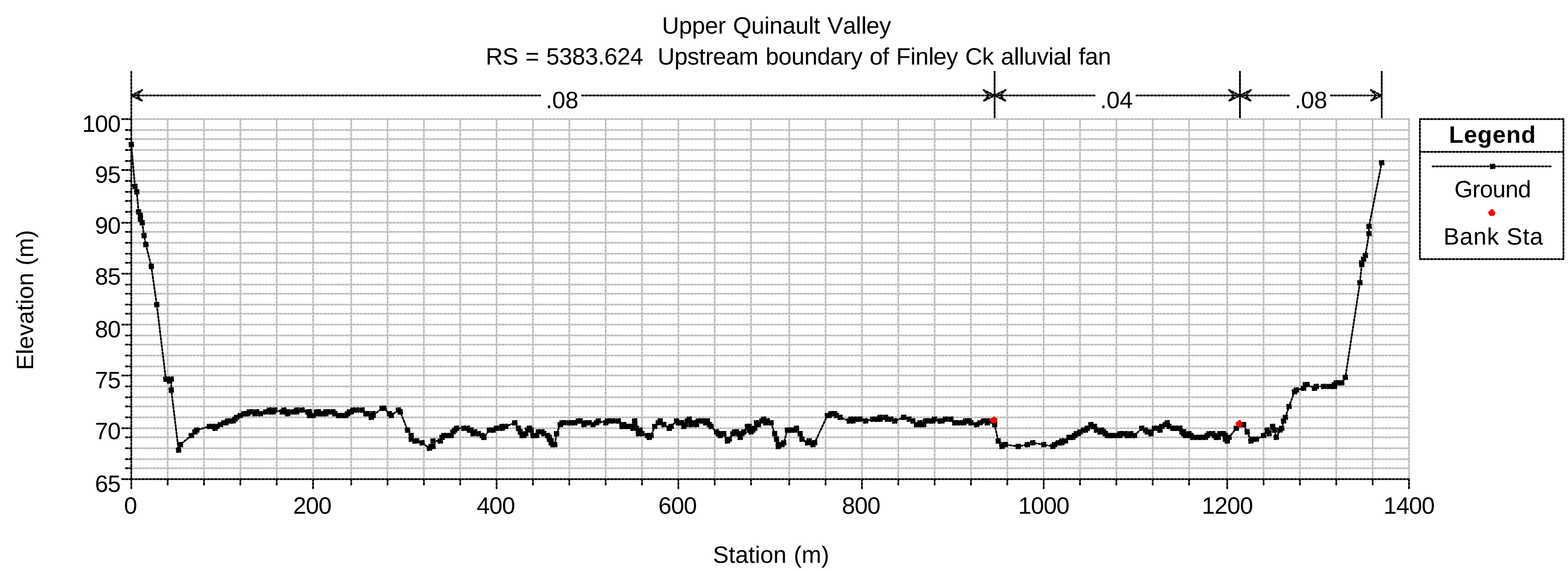

Upper Quinault Valley
RS = 6486.441
.08
.04
.08
Elevation (m)
110
100
90
80
70
0
500
1000
1500
2000
Station (m)
Legend
Ground
Bank Sta
Upper Quinault Valley
RS = 6201.589
.08
.04
.08
Elevation (m)
120
110
100
90
80
70
60
0
200
400
600
800
1000
1200
1400
1600
1800
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
RS = 6008.646
.08
.04
.08
Elevation (m)
120
110
100
90
80
70
60
0
200
400
600
800
1000
1200
1400
1600
1800
Station (m)
Legend
Ground
Bank Sta

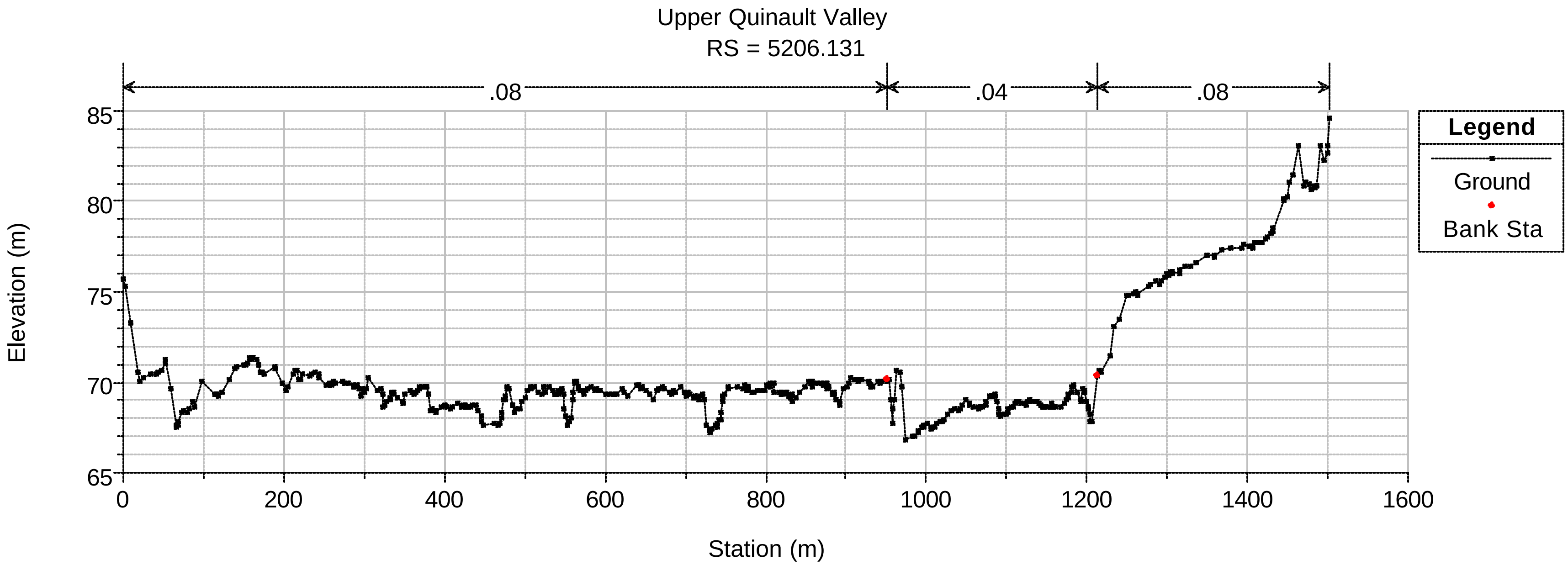

Upper Quinault Valley
RS = 5836.743
.08
.04
.08
Elevation (m)
120
110
100
90
80
70
60
0
200
400
600
800
1000
1200
1400
1600
Station (m)
Legend
Ground
Bank Sta

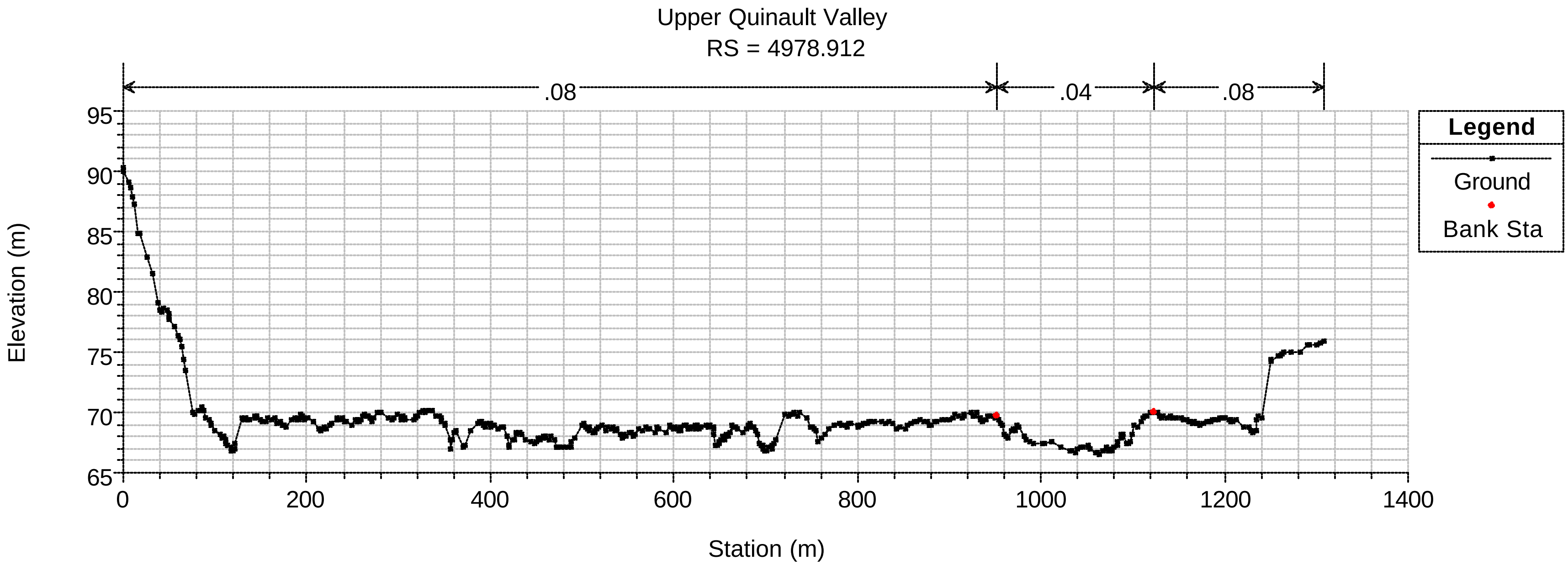


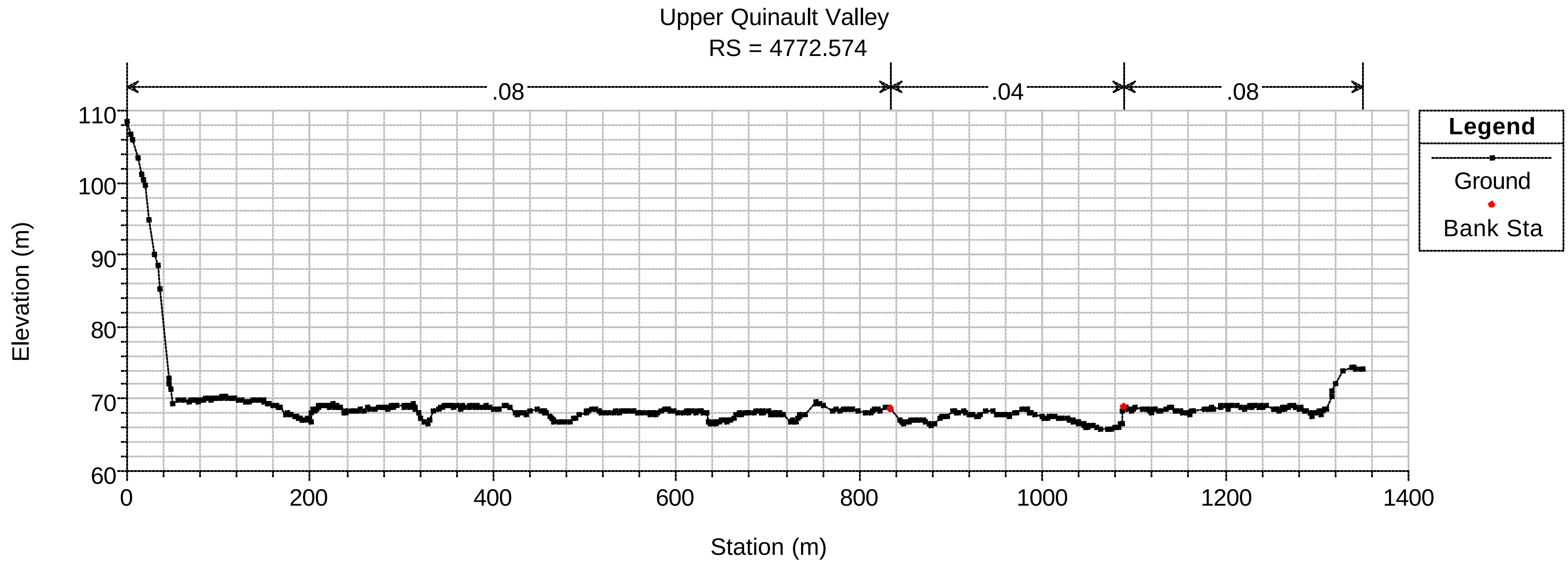
Upper Quinault Valley
RS = 5678.102
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta



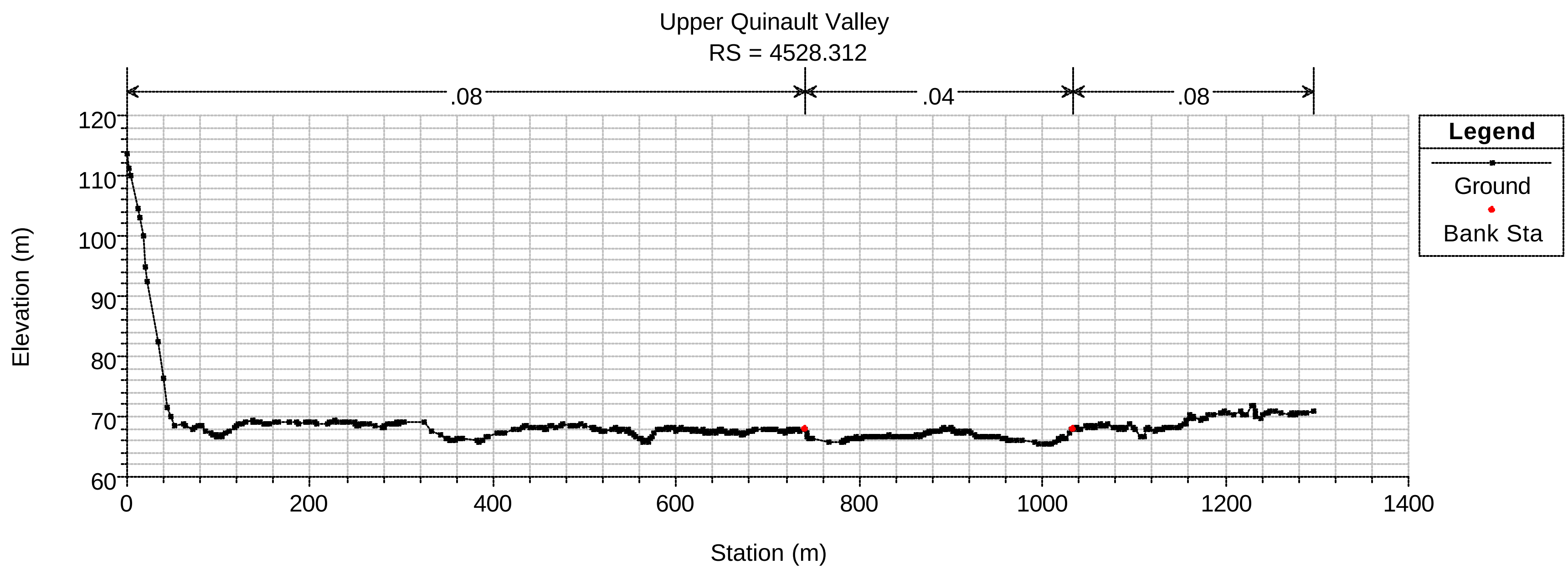
Upper Quinault Valley
RS = 5383.624 Upstream boundary of Finley Ck alluvial fan
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
RS = 5206.131
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta

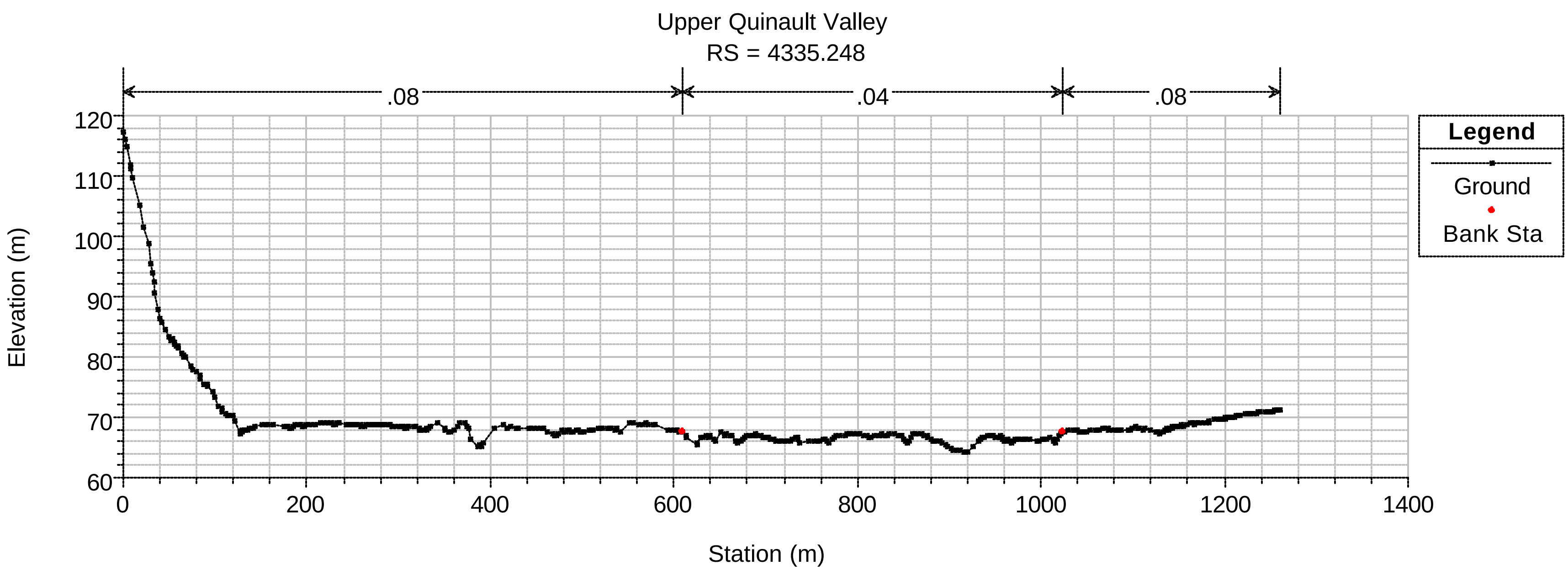

Upper Quinault Valley
RS = 4978.912
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta

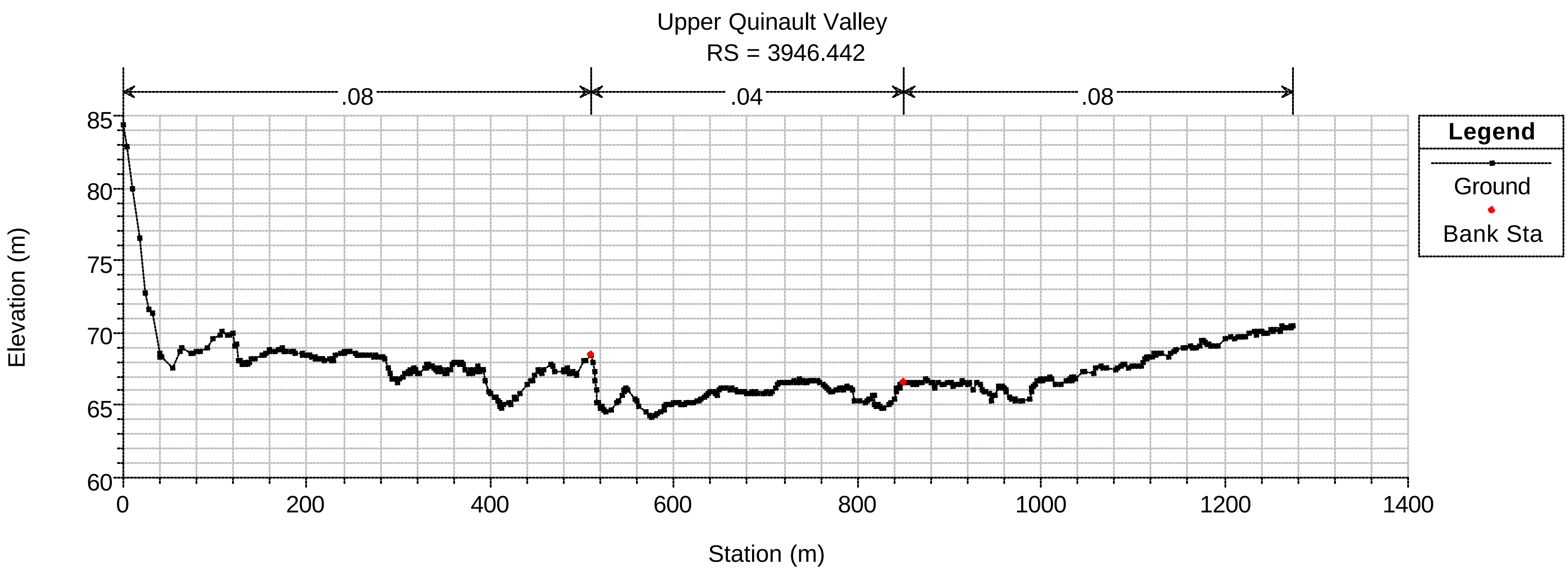


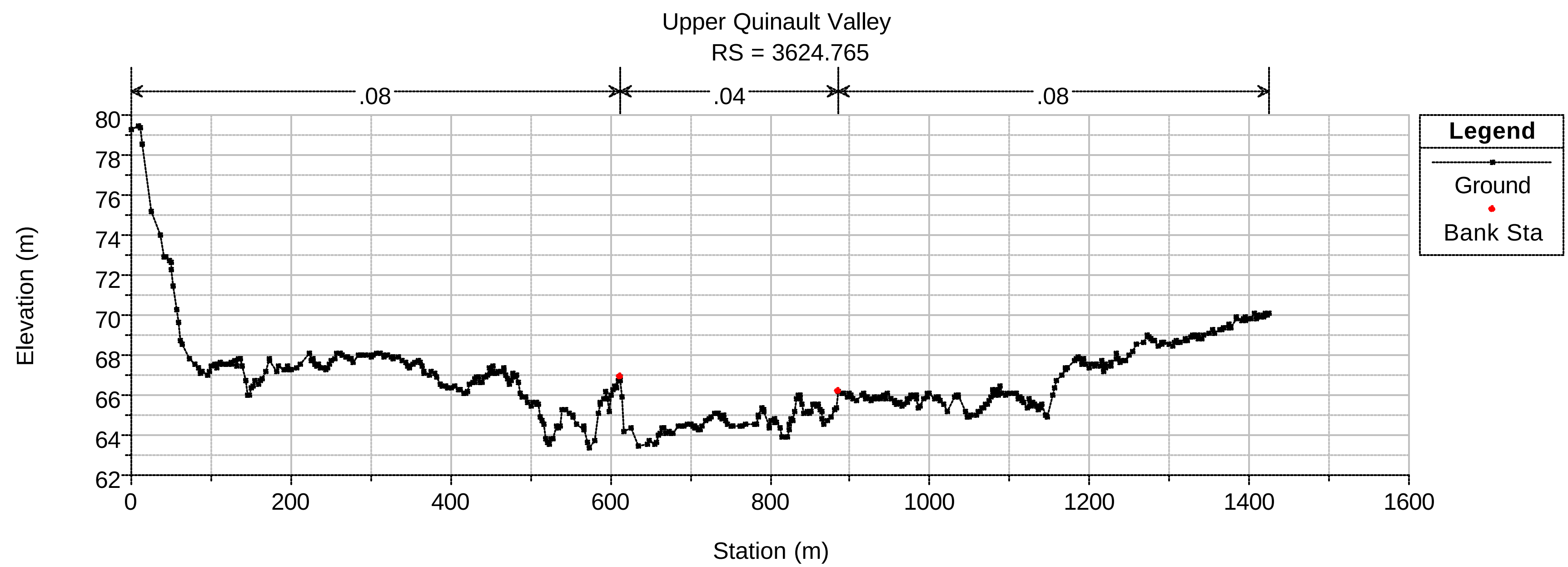
Upper Quinault Valley
RS = 4772.574
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
60
70
80
90
100
110
0
200
400
600
800
1000
1200
1400

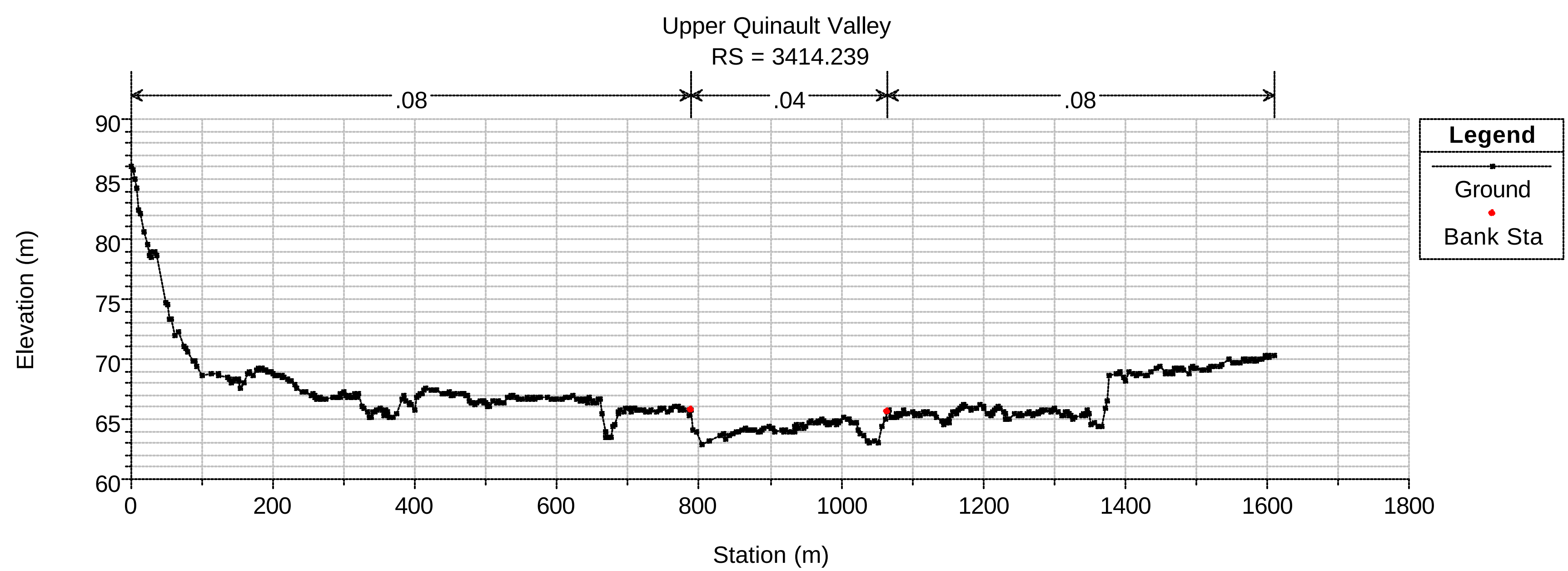


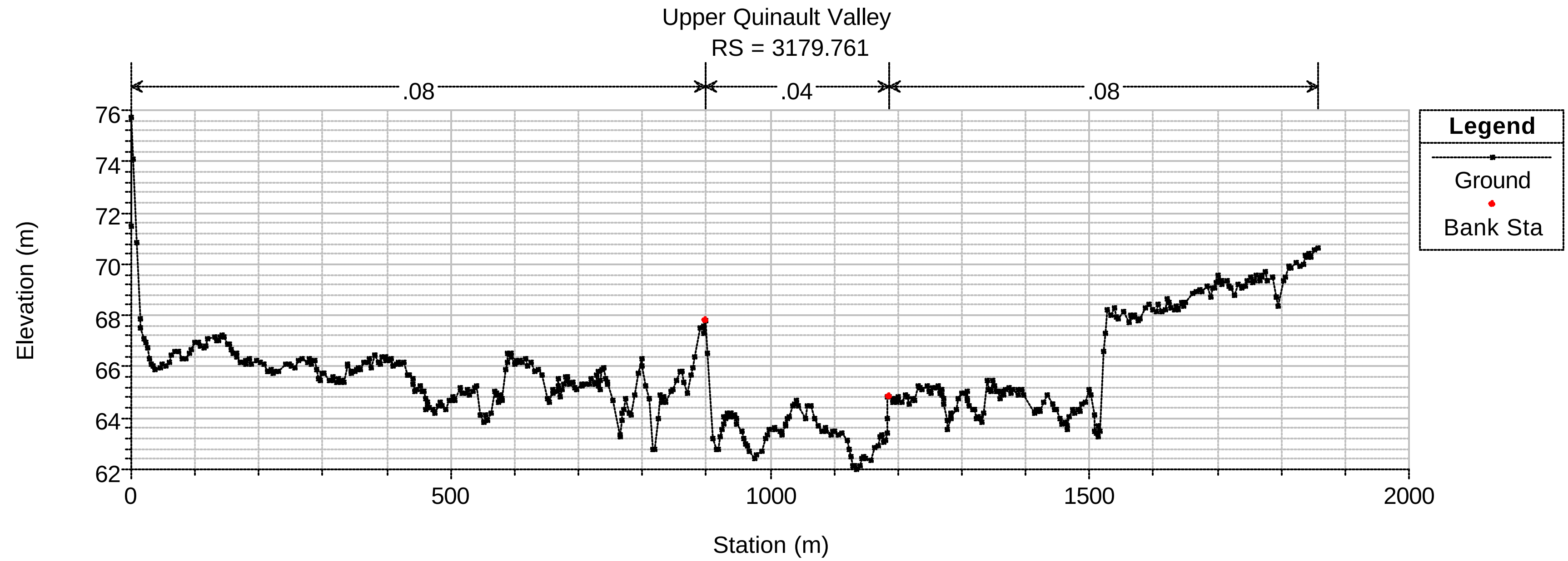
Upper Quinault Valley
RS = 4528.312
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
60
70
80
90
100
110
120
0
200
400
600
800
1000
1200
1400


Upper Quinault Valley
RS = 4335.248
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
120
110
100
90
80
70
60
0
200
400
600
800
1000
1200
1400

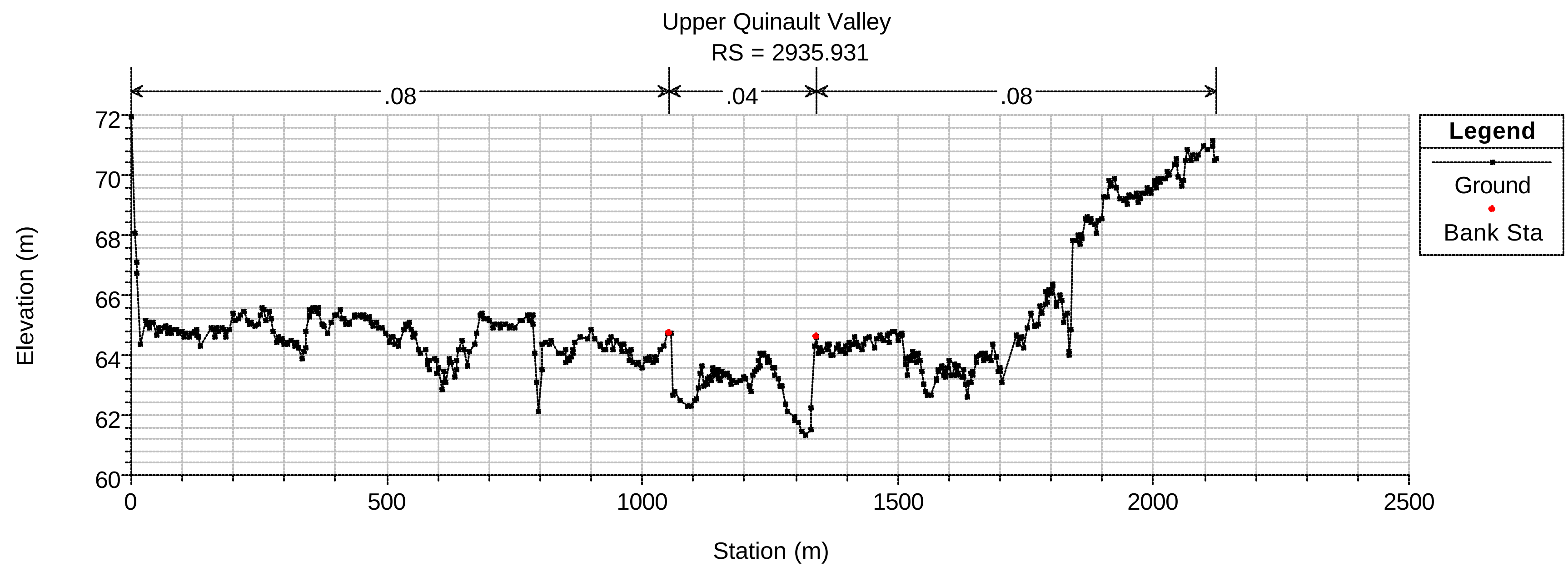

Upper Quinault Valley
RS = 3946.442
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
85
80
75
70
65
60
0
200
400
600
800
1000
1200
1400


Upper Quinault Valley
RS = 3624.765
.08
.04
.08
Elevation (m)
80
78
76
74
72
70
68
66
64
62
0
200
400
600
800
1000
1200
1400
1600
Station (m)
Legend
Ground
Bank Sta

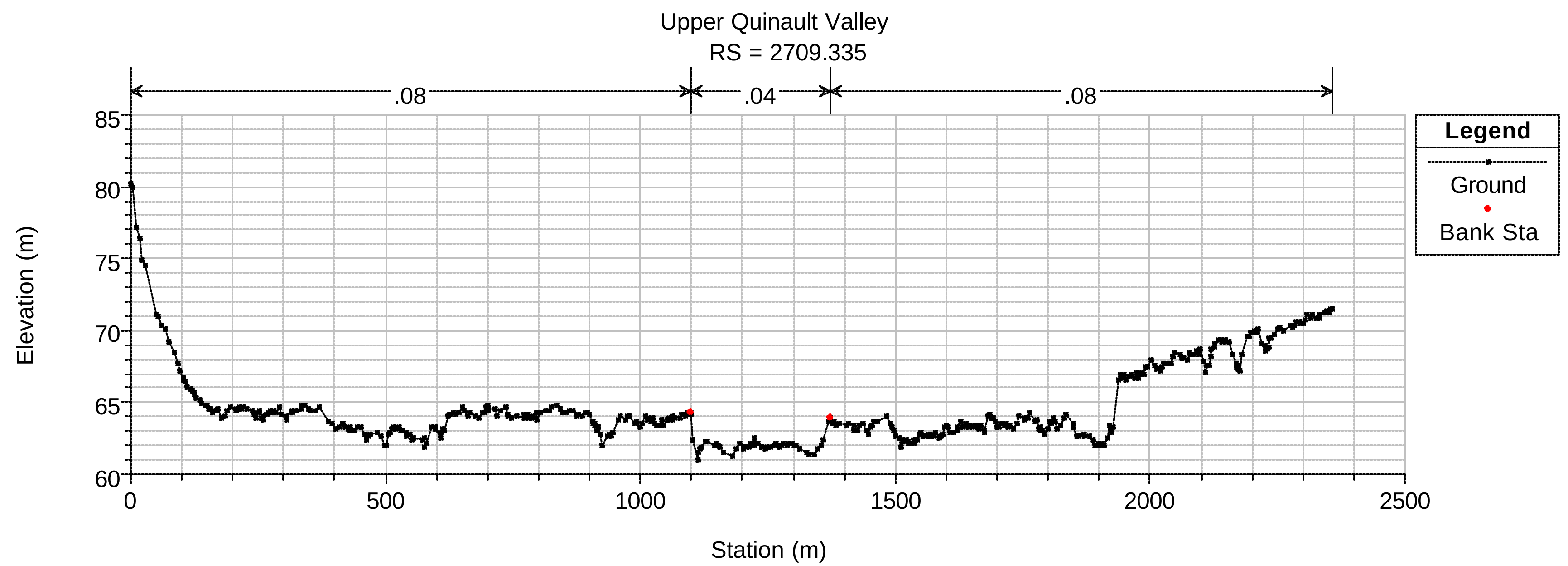

Upper Quinault Valley
RS = 3414.239
.08
.04
.08
Elevation (m)
90
85
80
75
70
65
60
0
200
400
600
800
1000
1200
1400
1600
1800
Station (m)
Legend
Ground
Bank Sta

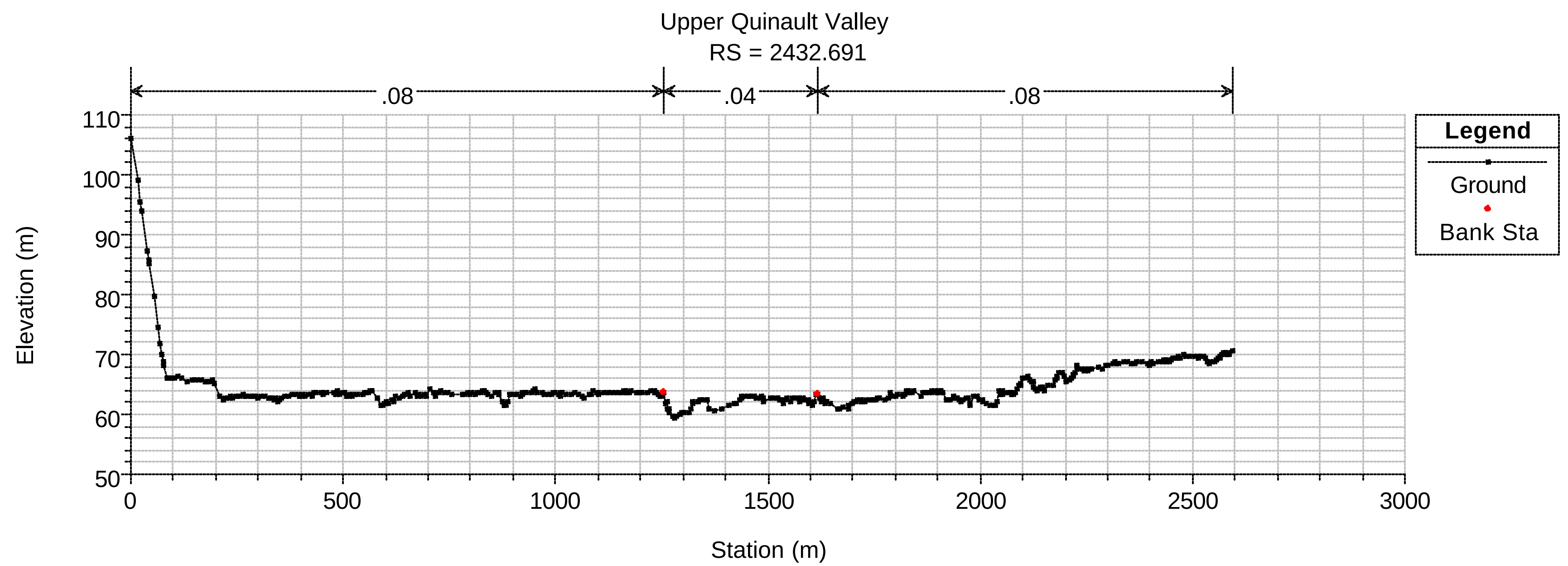


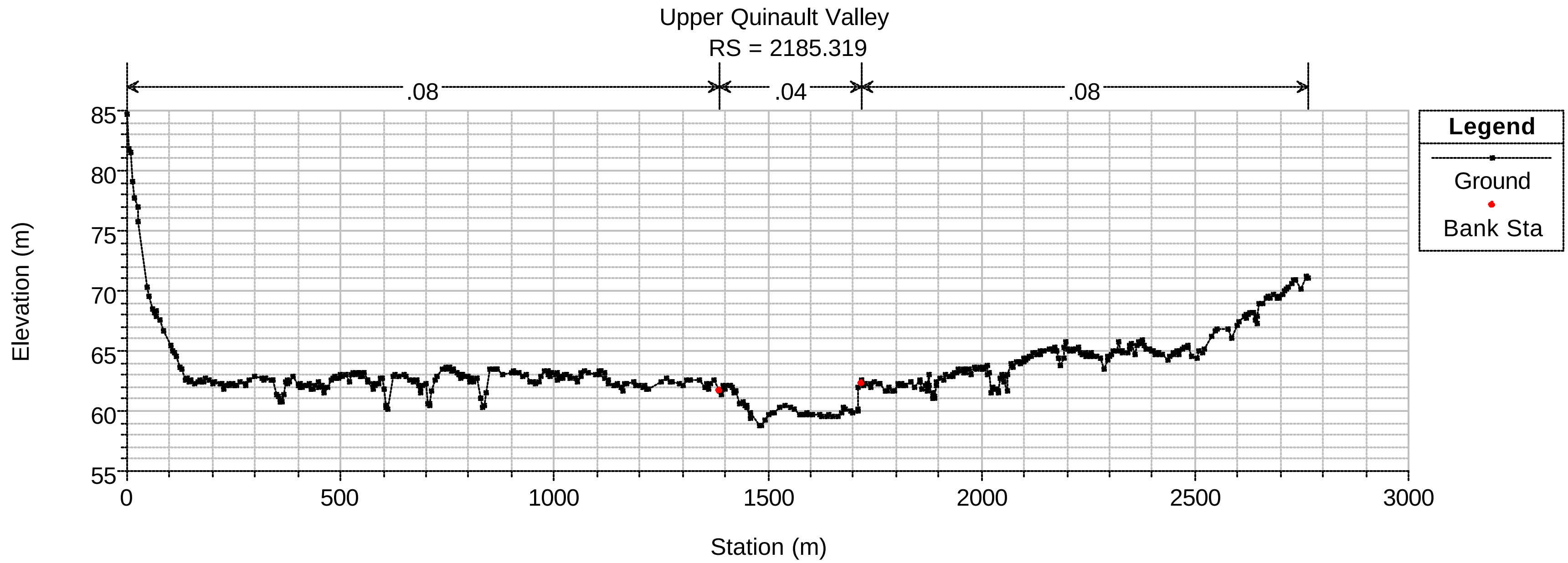
Upper Quinault Valley
RS = 3179.761
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
76
74
72
70
68
66
64
62
0
500
1000
1500
2000

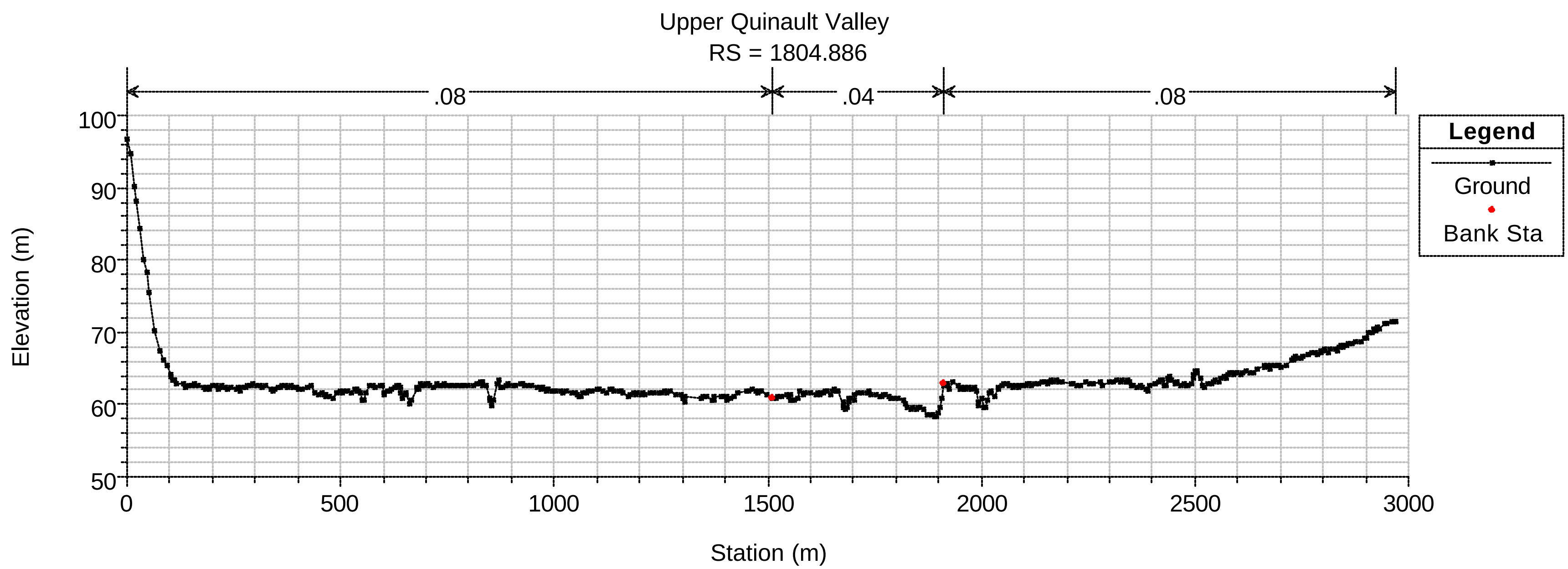


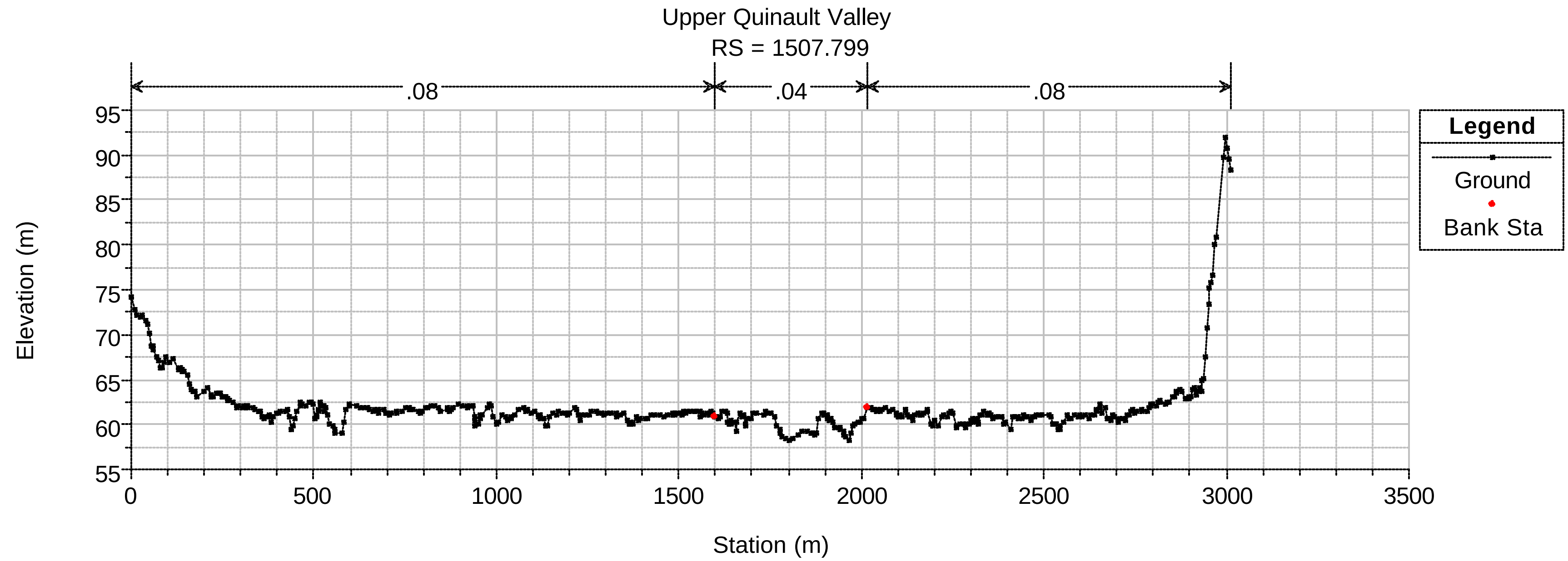
Upper Quinault Valley
RS = 2935.931
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
72
70
68
66
64
62
60
0
500
1000
1500
2000
2500


Upper Quinault Valley
RS = 2709.335
.08
.04
.08
Elevation (m)
85
80
75
70
65
60
0
500
1000
1500
2000
2500
Station (m)
Legend
Ground
Bank Sta

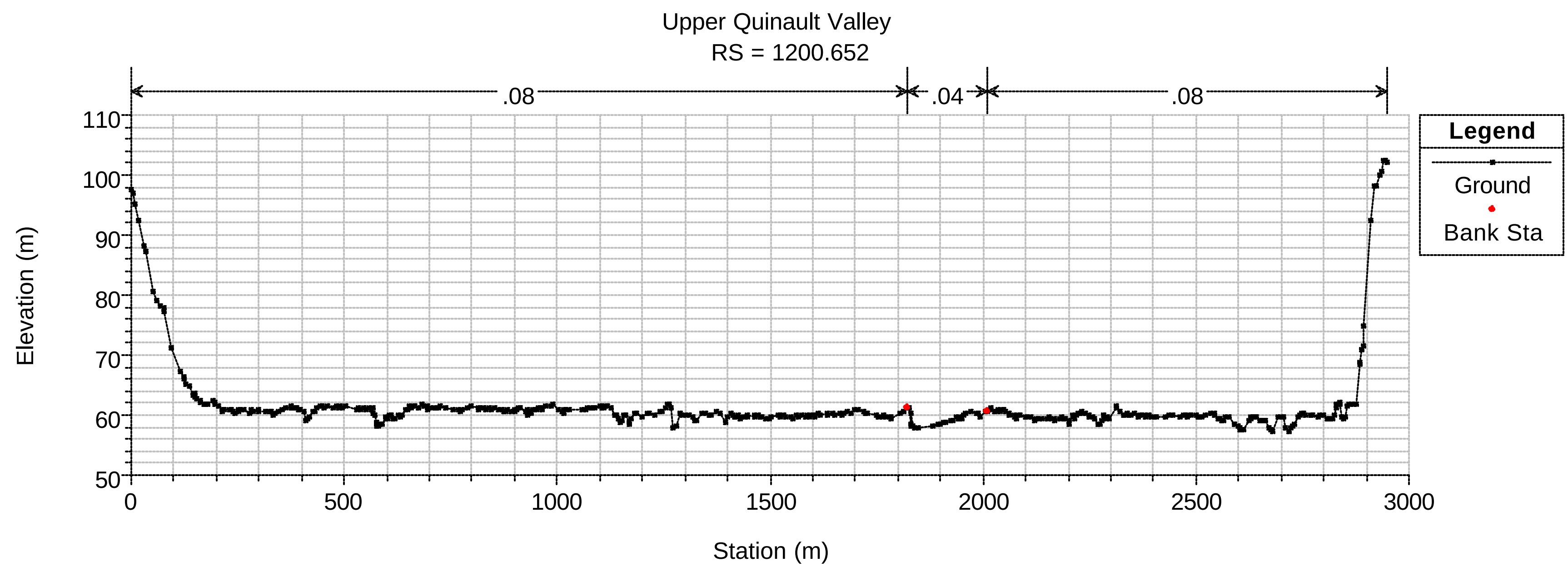

Upper Quinault Valley
RS = 2432.691
.08
.04
.08
Elevation (m)
110
100
90
80
70
60
50
0
500
1000
1500
2000
2500
3000
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
RS = 2185.319
.08
.04
.08
Elevation (m)
85
80
75
70
65
60
55
0
500
1000
1500
2000
2500
3000
Station (m)
Legend
Ground
Bank Sta

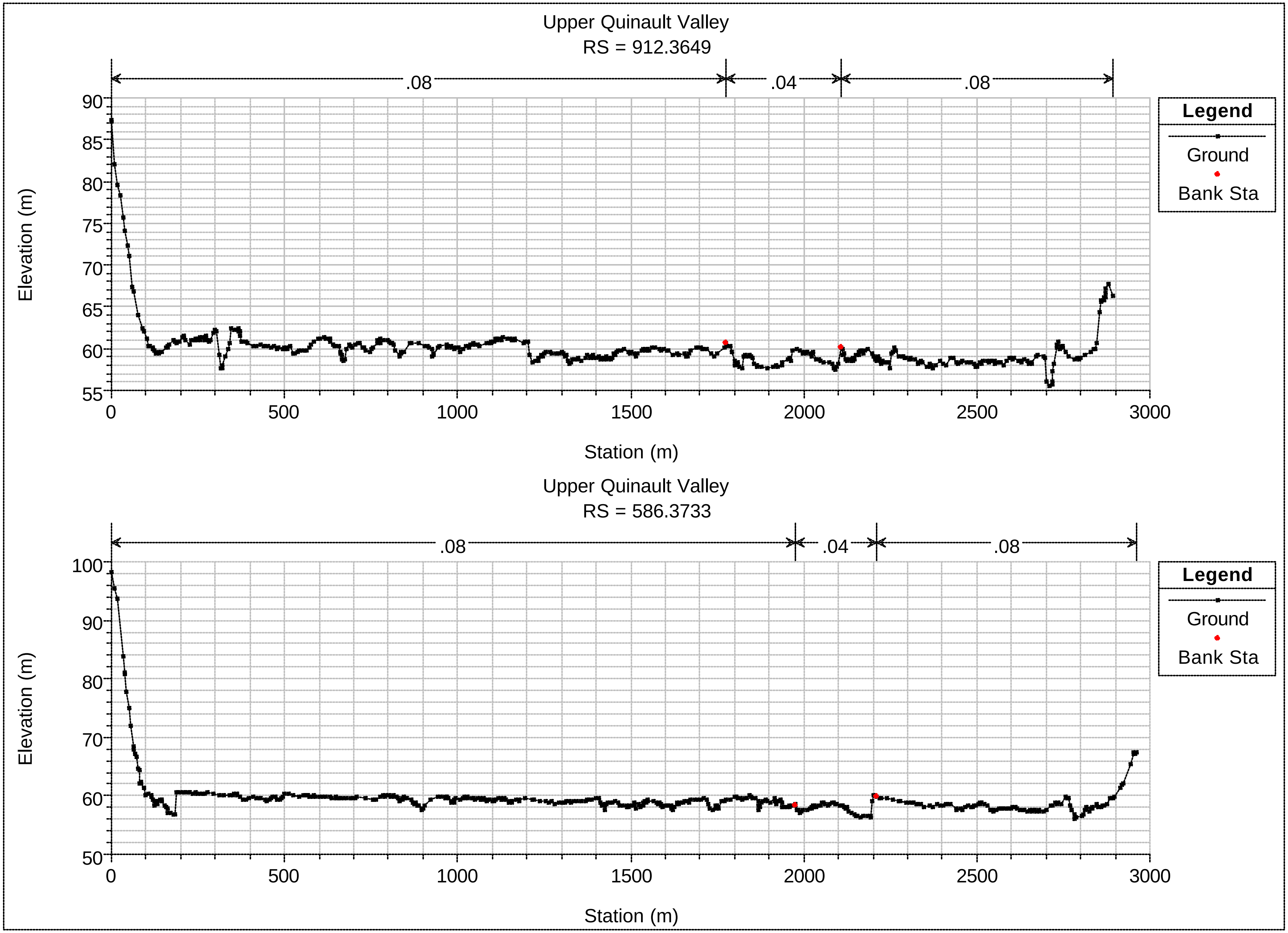

Upper Quinault Valley
RS = 1804.886
.08
.04
.08
Elevation (m)
100
90
80
70
60
50
0
500
1000
1500
2000
2500
3000
Station (m)
Legend
Ground
Bank Sta

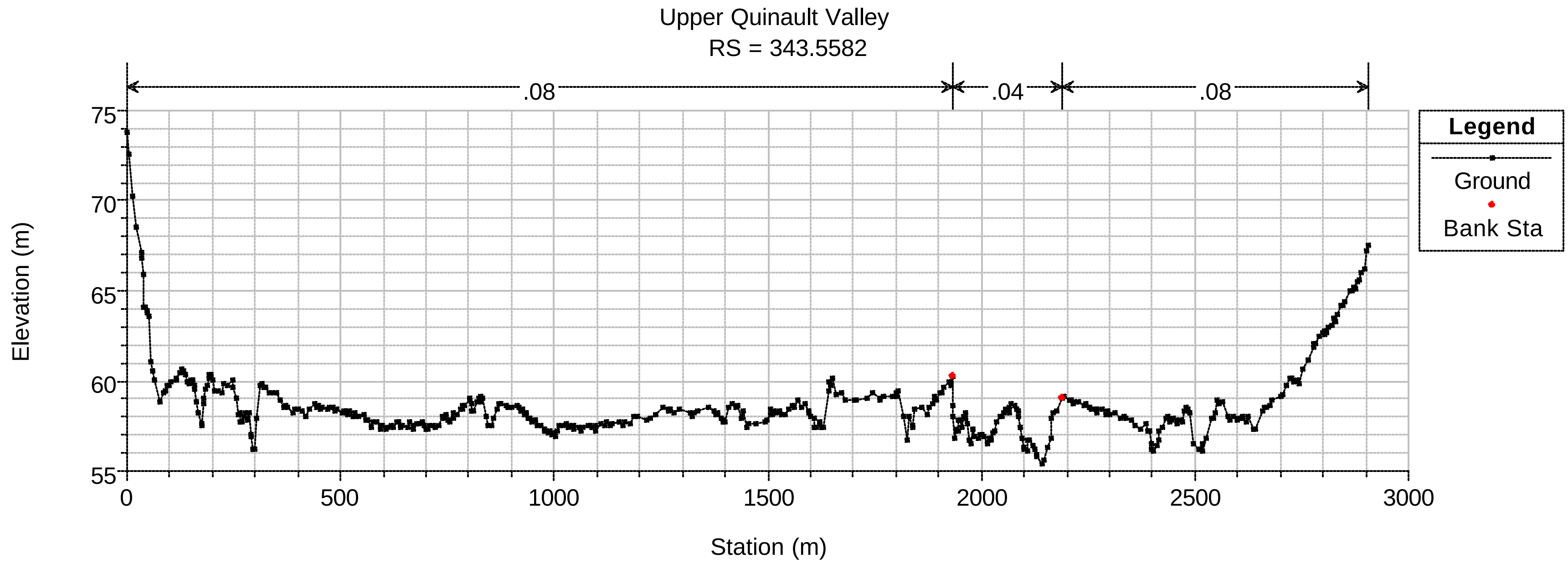


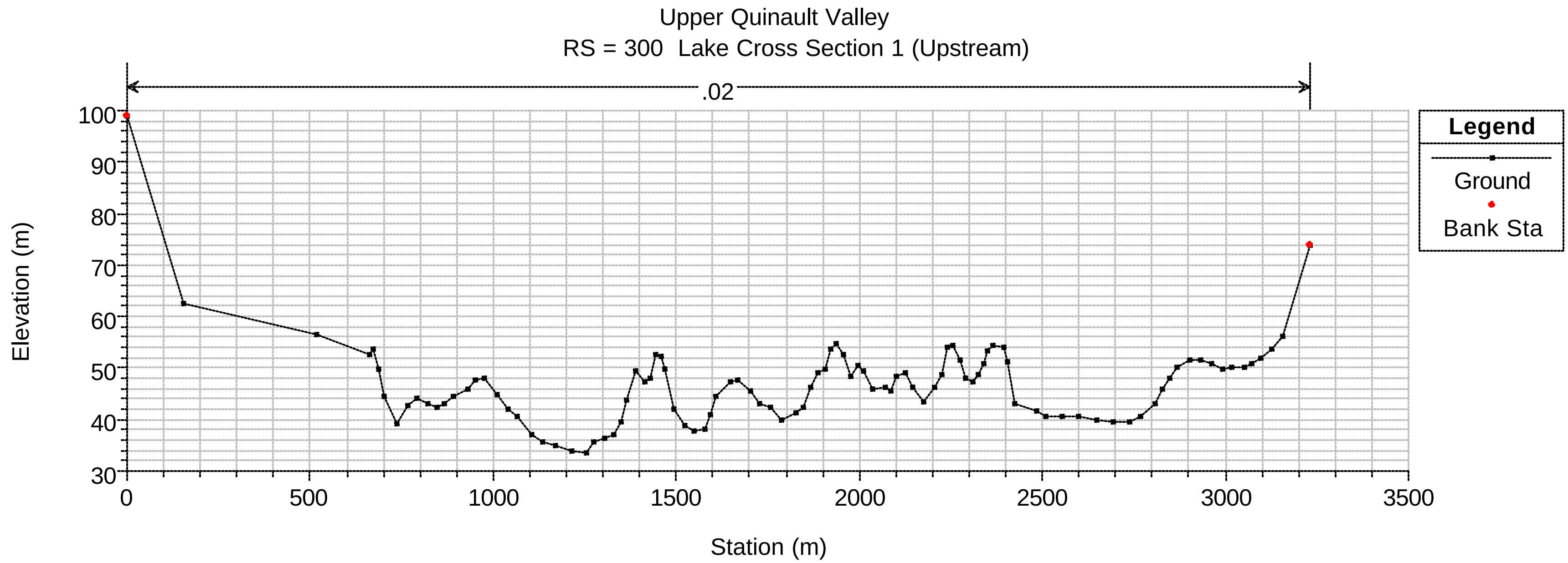
Upper Quinault Valley
RS = 1507.799
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
95
90
85
80
75
70
65
60
55
0
500
1000
1500
2000
2500
3000
3500
Station (m)

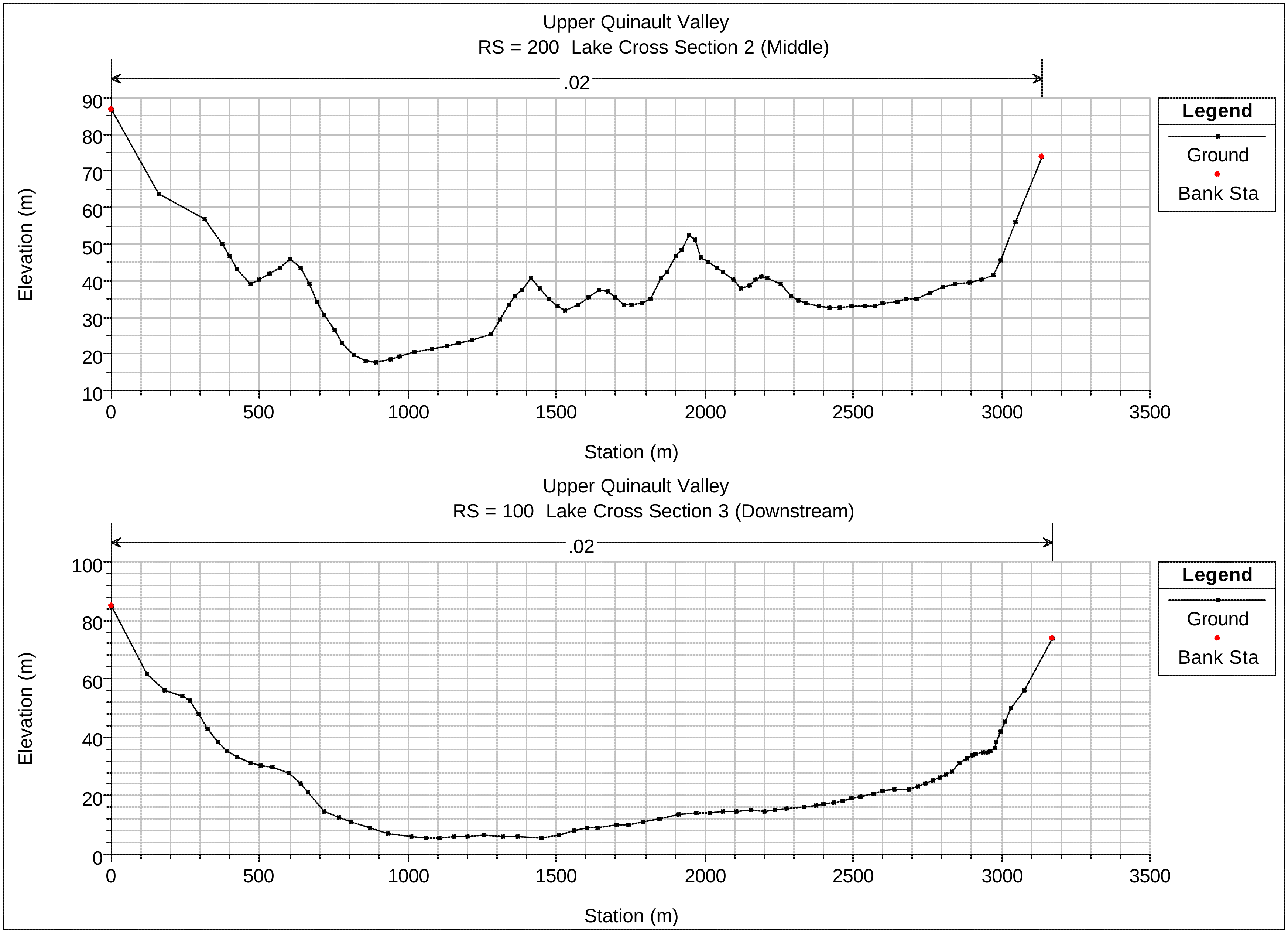


Upper Quinault Valley
RS = 1200.652
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
110
100
90
80
70
60
50
0
500
1000
1500
2000
2500
3000
Station (m)


Upper Quinault Valley
RS = 912.3649
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
90
85
80
75
70
65
60
55
0
500
1000
1500
2000
2500
3000
Upper Quinault Valley
RS = 586.3733
.08
.04
.08
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
100
90
80
70
60
50
0
500
1000
1500
2000
2500
3000


Upper Quinault Valley
RS = 343.5582
.08
.04
.08
Elevation (m)
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
RS = 300 Lake Cross Section 1 (Upstream)
.02
Elevation (m)
Station (m)
Legend
Ground
Bank Sta


Upper Quinault Valley
RS = 200 Lake Cross Section 2 (Middle)
.02
Elevation (m)
Station (m)
Legend
Ground
Bank Sta
Upper Quinault Valley
RS = 100 Lake Cross Section 3 (Downstream)
.02
Elevation (m)
Station (m)
Legend
Ground
Bank Sta